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A CLINICAL RADIOLOGICAL STUDY OF THE GALL BLADDER ¹

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IN recent years there has been much discussion regarding the actual value of the roentgen ray in the determination of cholecystic disease. Are the high percentages of certain authors correct; are they fallacies; has the authors' enthusiasm led them astray; are the favorable results reported to be accepted at face value, or should the method be discounted? Bearing these factors in mind a clinical study was begun a year ago among the internist, the surgeon, and the roentgenologist in an attempt to procure a limited series of particularly well controlled cases. All cases were examined roentgenologically by the roentgenologist, clinically by the one internist, and those who were operated upon were operated on by the same surgeon, the internist being present at almost every operation so that pathological limits were very carefully determined.

For purposes of study the patients in our series were divided into three groups.

Group 1. A series of 25 cases of pathological gall bladders which came to operation and in which distinct gall-bladder pathology was found. Most of these were cases in which the clinical findings pointed to gall-bladder disease, but the group includes one case in which unexpected cholecystic pathology was found at operation.

Group 2. A series of 21 normal gall bladders, all operated on for other causes, in which the gall bladder at operation appeared normal. Most of these were gastric

or duodenal ulcer cases which came to operation following a complete roentgen study of the gastro-intestinal tract, including the gall bladder.

Group 3. A series of 56 cases which consisted of a group of normal controls in which no gall-bladder pathology was suspected either from the history or clinical examination, and which did not come to operation. The object of this group was to check Group 2 by means of a similar but larger series.

TECHNIC

Preparation of Patient.—Every type of preparation was attempted in order to determine whether there was an ideal preparation. Salines, compound licorice powder, mineral oil, castor oil, with and without enemas, with and without special feedings, etc., were tried until finally we arrived at the following routine: The patient to receive 1½ to 2 oz. castor oil at 9 o'clock the evening preceding the examination, nothing by mouth after this time, no breakfast, a single high colonic flushing one hour prior to the examination. This routine does not permit of the further ingestion of another meal, which would probably result in a large retention of food material in the intestinal tract. This gave us the best results in the majority of cases, the theory being that some hours after the last intake of food the cathartic administered would cleanse out the entire gastro-intestinal tract.

¹From the Adolf Stein Memorial for Research in Roentgenology. This work was supported by a grant from the Otto Baer Fund for Clinical Research. Read before the Radiological Society of North America, December, 1924, at Kansas City.

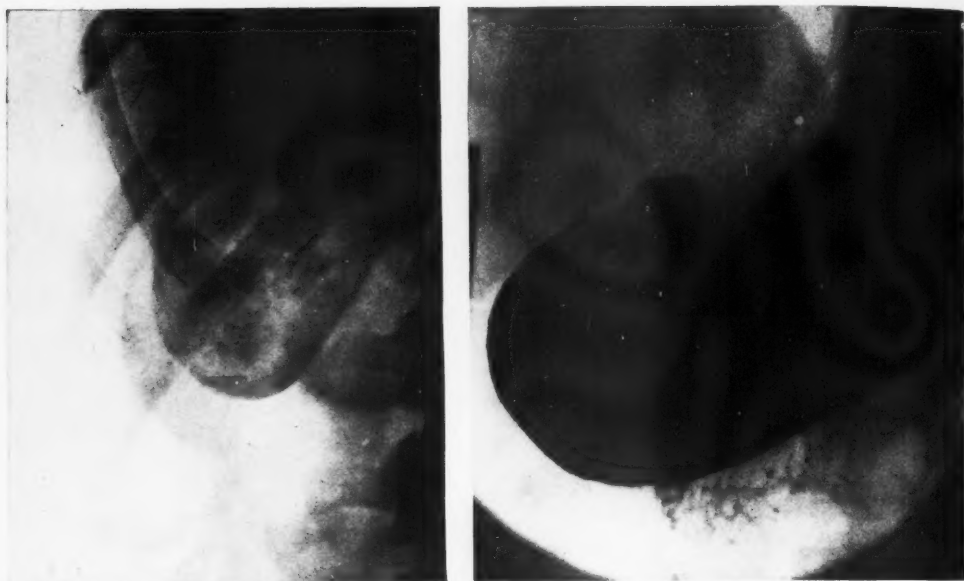


Fig. 1. Original gall-bladder film and a later film of the same area after ingestion of opaque meal, for correlation of shadows. Note outline of bulbous duodeni in gall-bladder area.²

One well-given enema is better than numerous enemas not properly controlled. Our conclusions are that no one preparation is adequate for all patients, and there are cases in which it is impossible to obtain a satisfactory result, regardless of preparation.

X-RAY TECHNIC

The radiographic technic is the same as has been described previously by numerous authors, including the speaker (R. A. A.); namely, to use a spark gap consistent with the patient's thickness, changing the gap at each exposure so that in a series of films the exposures will range from an under- to an over-penetration. The milliamperage, time, target-film distance, size of field, etc., remain the same throughout. The Bucky Diaphragm was used in every case.

A fluoroscopic examination was routinely made for the secondary findings, such as immobility, gall-bladder seats, duodenal stasis, localization of tender points, etc.

The most important item from the radiographic standpoint is the absolute immobilization of the patient's diaphragm, no easy

task when the patients are unable to comprehend the instructions that are given.

DIFFERENTIAL DIAGNOSIS OF SHADOWS

In order to properly interpret the various shadows that are seen on any gall-bladder film, a special film of the gall-bladder area was taken, localizing as for gall bladder, but after the patient had ingested an opaque meal. A sufficient length of time should elapse between the ingestion of the meal and the time of taking this film, so that the barium will have reached the ileum. The purpose of this special film is to procure a barium-filled antrum, cap, duodenum, jejunum and ileum, if possible, in order to compare these with the previously taken gall-bladder films, inasmuch as the bulbous duodeni, the duodenal arch, the ileum, etc., are frequently seen without filling with the opaque media. Mistakes frequently arise from confusing such shadows, especially, in our experience, those of the cap or pyloric antrum, for the gall-bladder shadow. By means of this extra film the percentages of such mistakes can be greatly diminished.

²All gall-bladder films retouched for purpose of publication.

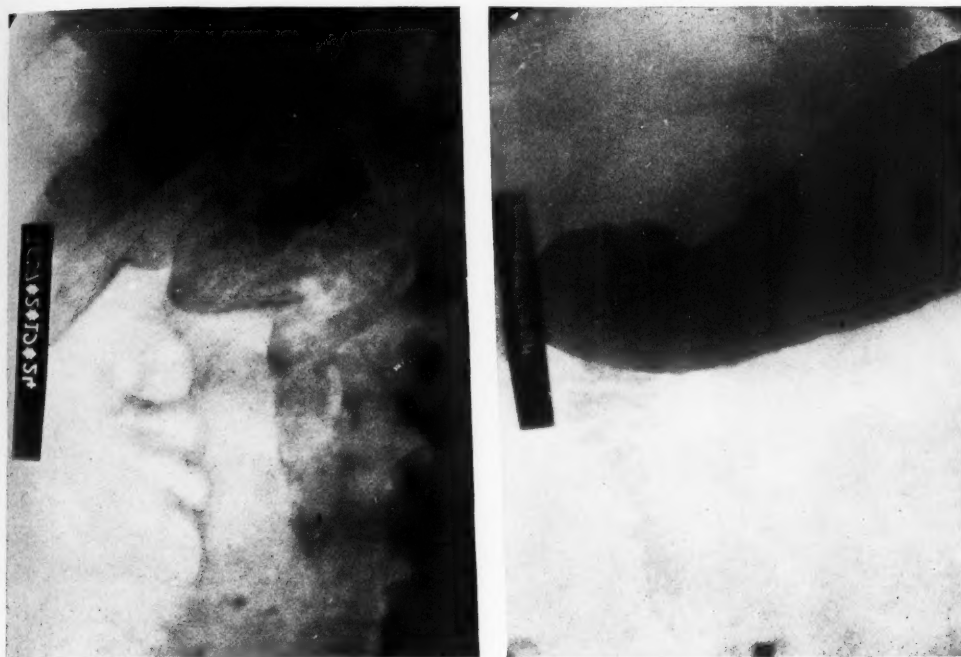


Fig. 2. Pyloric antrum partially covering gall-bladder outline.

Occasionally other shadows appear which are not those of the usual anatomical structures. Of these, mention will be made later.

EXAMINATION OF THE FILM

These are the direct findings.—The items to be especially noted here are gall-bladder outlines and stone shadows. The gall-bladder shadow is characteristic, the fundus being directed downward or to an angle inward or outward. The fundus may appear anywhere from under the liver margin down to the iliac crest. When sharply defined, we have called them positive shadows. When the gall-bladder outline is not so sharply defined, rather vague, and when we have to draw upon our experience to interpret this as the gall-bladder outline, then we have classified this as a doubtful shadow, yet positive from a roentgen standpoint. When gallstones have been visualized, even without visualizing the gall-bladder outline, we have considered this as a pathological gall bladder.

Indirect findings.—The indirect findings are the following: A gall-bladder seat in the pyloric antrum, bulbus duodeni, duodenum, or hepatic flexure; duodenal stasis manifesting itself by a regurgitation to and fro of the barium meal as it passes down the duodenum, not emptying into the jejunum as in the normal, frequently regurgitating back into the bulbus; angulation, distortion or fixation of the cap, pylorus and hepatic flexure. These are primarily fluoroscopic findings, yet the films usually disclose them.

The following tables will illustrate the roentgen findings and their accuracy as checked by the clinician and the surgeon.

COMMENTS

It will be noted that there was a distinct or doubtful gall-bladder shadow in 88 per cent of Group 1. These are the shadows left after the shadows of the bulbus duodeni, pyloric antrum, duodenal arch, etc., shown by the *extra* barium meal film taken in the gall-bladder position, have been compared with the gall-bladder films and been

TABLE I
Gall-bladder Shadows

	Positive shadows		Doubtful shadows		Pos. and doubtful shadows	No shadows	
	No.	Per cent	No.	Per cent	Per cent	No.	Per cent
Group 1, 25 cases	17	68	5	20	88	3	12
Group 2, 21 cases	2	9.6	1	4.7	14.3	18	85.7
Group 3, 56 cases	7	12.5	10	17.9	30.4	39	69.6

TABLE II
Gall-bladder Seats

	Pos. G. B. shadows and pos. seat	Doubtful G. B. shadow and pos. seat	No shadow and pos. seat	Per cent of pos. seats	No. of shallow seats	Per cent of pathological seats
Group 1, 23 cases included	10	3	2	65	2	56
Group 2, 21 cases	1	1	0	9.5	1	5
Group 3, 56 cases	2	1	7	17.9	5	8.9

TABLE III
Duodenal Stasis

	Pos. G. B. shadow with stasis	Doubtful G. B. shadow with stasis	No G. B. shadow with stasis	Per cent of stasis
Group 1, stasis not noted in all cases	2	1	0	23
Group 2	1	0	2	14.3
Group 3	0	2	1	5.4

eliminated. Thus our percentage of gall-bladder shadows is smaller than would otherwise be the case. The pathology of these cases noted at operation was of three types.

A. Those filled with stones, with or without thickened walls, of which there were nine cases.

B. Those with only thickened walls and no stones in the gall bladder, of which there were twelve cases. We noticed no difference in the percentage of positive cases in Types A and B. A thick-walled gall bladder casts as dense a shadow on the film as a bladder filled with stones, unless they be of the calcified type.

C. This type includes four cases in which the gall bladder was markedly distended, but the walls were of normal thickness. This is the stasis gall bladder of Von Schmieden, and is an overfilling due to an increased difficulty in emptying. The obstruction may be due to increased tortuosity of the cystic duct, to kinking of the duct, congenital anomalies, or adhesions, and leads ultimately to distention of the gall bladder with atrophy of the muscular coat. These thin-walled distended gall bladders gave positive shadows in three out of four cases, or 75 per cent, while all pathological types gave, as stated, above 88 per cent positive results. Inasmuch as the Von

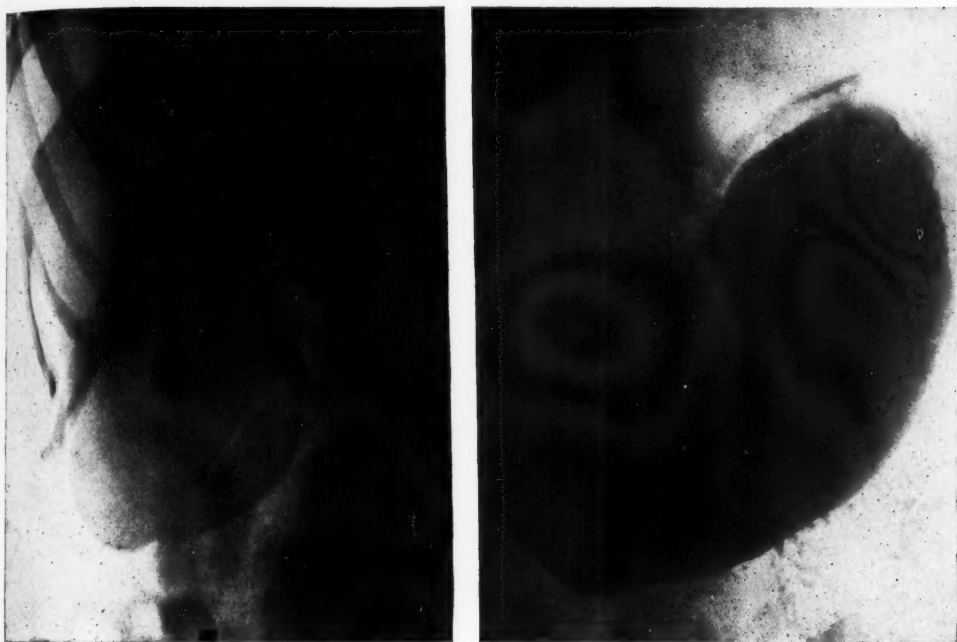


Fig. 3. Long oval shadow parallel to outer half of costal arch.

Schmieden type is clinically difficult to diagnose, the X-ray is surely of value here. In this group 65 per cent of the cases showed gall-bladder seats and 23 per cent stasis (see Tables II and III, Group 1).

It is interesting to note, however, that practically all the positive indirect evidence occurred in cases with positive gall-bladder shadows, and therefore would not have been of particular value as a diagnostic aid. Gall-bladder seats were noted in Group 1 in two cases without gall-bladder shadows. Both of them, however, were of the superficial type which we have found in cases with perfectly normal gall bladders. We should, therefore, discard these two cases and consider only 56 per cent positive gall-bladder seats, namely, only those of the deeper type. The same is true of stasis. No cases are recorded in Group 1 in the three cases without gall-bladder shadow, yet the indirect findings, if they are sufficiently pronounced, with inability to obtain satisfactory films of the gall-bladder area, are of definite value. In Group

2, considering all gall bladders demonstrated normal by operation, 3, or 14.3 per cent, gave positive shadows, and 85.7 per cent no shadows. Of the three positive cases two were of the same type of shadows, namely, long, oval and parallel to the outer half of the costal arch (see Fig. 3). At operation this shadow in one case seemed to be a projection of the lower boundary of an anomalous liver furrow in this position. Another similar shadow in the same position could be accounted for in no way at operation. However, we feel sure that in the future these two errors, due to this type of shadow, would not be repeated. It was in one of the last two cases mentioned that a typical shallow seat was present in the cap, therefore our exclusion of such as an indication of pathology.

In Group 2 only 5 per cent show pathological seats and 3, or 14.3 per cent, show stasis. Of these latter three, one was a duodenal ulcer, one a colitis, both with normal gall bladders, and one a duodenal ulcer in which the gall bladder had been

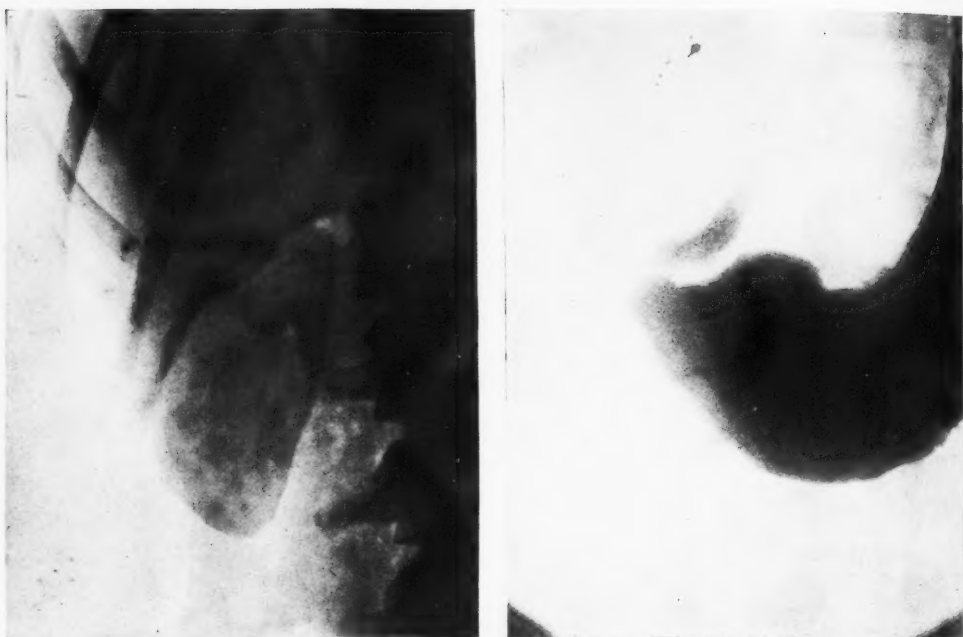


Fig. 4. Bulbus duodeni pressing against gall-bladder seat.



Fig. 5. Gall-bladder shadow and pressure seat in cap posteriorly.

removed two years before. Stasis is, therefore, apparently almost as frequent in normal gall-bladder cases as in pathological, and is as yet of comparatively little value in determining gall-bladder pathology. In another larger series of gastro-intestinal cases it was noted in 21.6 per cent of normal cases, whereas in the same series stasis was present in 36 per cent in which the gall bladder was determined to be pathological. Its meaning is still not definitely determined. Two of the cases of stasis in this group occurred in patients who showed no gall-bladder shadows, and had we placed too much reliance on this finding our diagnostic error would have been higher.

In Group 3 we found 30.4 per cent positive and doubtful gall-bladder shadows. This did not, however, represent an error of 30 per cent. In one case, for instance, a distinct gallstone was visible; therefore it is probable that some others of the 7 positive shadows indicated real, but symptomless gall-bladder pathology. If we consider that there were five definite deep gall-



Fig. 6. Gall-bladder shadow.

bladder seats in this group, of which three occurred in cases of positive and doubtful gall-bladder shadows, I am sure we are conservative in considering all of these as

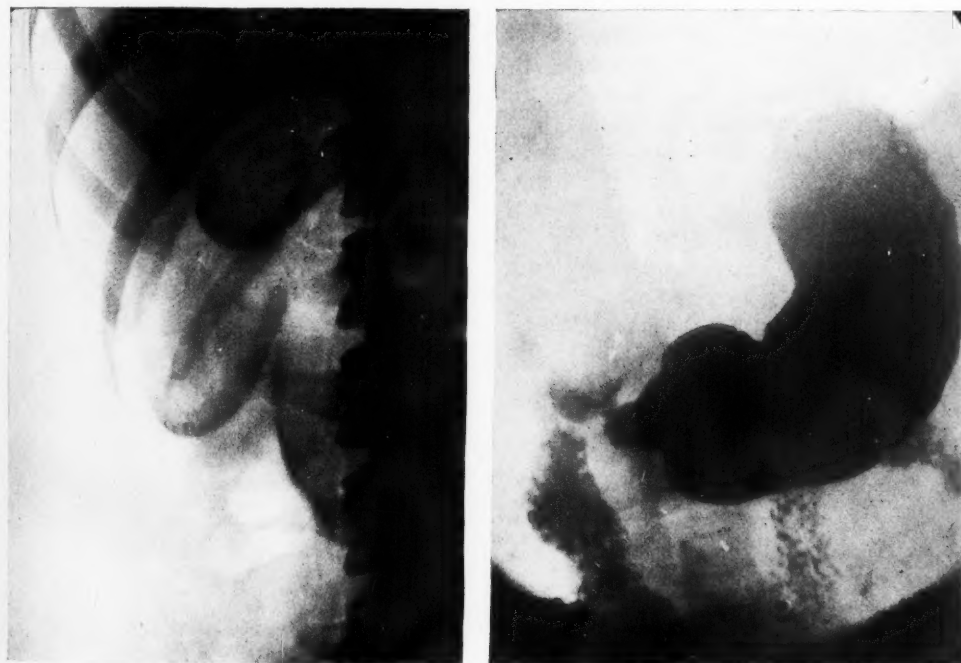


Fig. 7. Gall-bladder shadow and ulcer defect in cap posteriorly.



Fig. 8. Large gall-bladder shadow with long shallow gall-bladder seat in pyloric antrum.

pathological cases. This reduces our error by 5 per cent, increasing the diagnostic accuracy to 75 per cent. It probably is less than this, as we have such a large number of doubtful shadows (10) in this group, which should be reduced greatly by improved technic. This group is interesting as showing a weak spot in present methods. Stasis was present in only 5.4 per cent of the cases in this group.

The statistics we have quoted, we believe, give a rather accurate summary of what is possible by roentgen methods. This is the first check-up of a normal series of cases, to our knowledge, that has been reported and confirms previous statistics on pathological gall bladders as reported by George, Kirklin and Arens. We are con-

vinced that the visualized gall bladder, taking into consideration both the direct and indirect findings by roentgen methods, is an extremely valuable adjunct to medicine and that its value is vastly underestimated by the entire profession.

CONCLUSIONS

(1) In pathological gall bladders, verified at operation, the diagnostic accuracy of the roentgen ray is 88 per cent. (2) In normal gall bladders, verified at operation, 85 per cent. (3) In normal gall bladders, not verified by operation, 75 per cent. (4) Deep gall-bladder seats wherever found are an indication of pathology—a shallow one not necessarily. (5) Stasis is as yet a sign of doubtful value.

THE ROENTGENOLOGIC DIAGNOSIS OF DISEASE OF THE GALL BLADDER ¹

By RUSSELL D. CARMAN, M.D., Section on Roentgenology, Mayo Clinic, ROCHESTER, MINNESOTA

AT the Mayo Clinic, during the last two years, more than 8,000 patients in whom disease of the gall bladder was suspected have been examined with the X-ray, and about 2,000 of these have been operated on.

Previous to the advent of Graham's method there has been nothing, aside from the shadow of gallstones, on which one could routinely base a positive roentgenologic diagnosis of cholecystic disease. A shadow of the gall bladder itself by radiography without dye, may or may not indicate a diseased condition. Secondary signs, such as pressure deformity of the gastric antrum or duodenum, or deformity of the hepatic flexure of the colon, while seen occasionally in disease of the gall bladder, are often present in normal cases.

For the last two years we have been studying this subject rather intensively with the hope of finding radiologic signs of cholecystic disease which would be as reliable as the signs of gastro-intestinal lesions, and which could be used in the same way, that is to say, without reference to clinical data. In my opinion, this is possible only by using a dye which is excreted in the bile

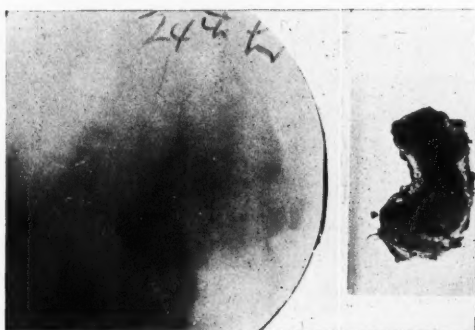


Fig. 2. Small amount of dye in fundus of gall bladder at the eighth hour only. Photograph of specimen: chronic cholecystitis; multiple small stones.

and is opaque to the X-ray, just as barium in the stomach is opaque.

With the Graham test, the gall bladder normally contains sufficient dye to cast a shadow at the fourth or fifth hour after administration. This shadow attains its greatest intensity some time between the eighth and twenty-fourth hours, becomes progressively thinner thereafter, and should disappear between the twenty-fourth and forty-eighth hours. The shadow is oval or pyriform, with an even contour, and should be homogeneous. It is larger at earlier than



Fig. 1. Normal response to the Graham test. Shadow of the gall bladder at the fifth, eighth and twenty-fourth hours, reading from left to right. The gall bladder is larger at the eighth hour (center) than at the fifth (left) and twenty-fourth (right) hours. The shadow is homogeneous; its density increases progressively, and the contour of the gall bladder is regular.

¹Read before the Radiological Society of North America, at Kansas City, Missouri, December 8-12, 1924.

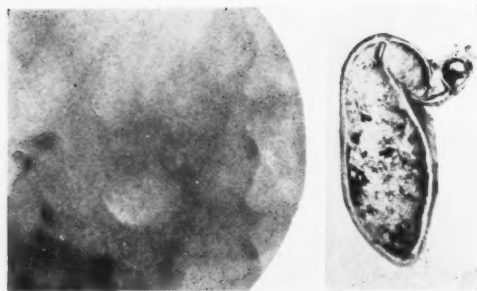


Fig. 3. Small amount of dye in fundus of gall bladder at the twenty-fourth hour only. Photograph of specimen: chronic cholecystitis; stone in the cystic duct.

at succeeding hours. This variation in size is very good evidence of normal distensibility of the gall bladder.

Abnormal responses include failure of the gall bladder to fill with the dye, scanty filling as shown by persistent faintness of the shadow, partial filling, deformity of contour, and mottling, or central defects.

Prior to September 1, 1924, 178 patients had been examined at the Clinic by the Graham method. Of these, thirty-nine, all with diseased gall bladders, have been operated on, and thirty-four of them gave abnormal responses to the test. In nineteen of twenty-



Fig. 5. Persistent faint shadow of the gall bladder at all hours (shown here at the twenty-fourth hour). Photograph of specimen: cholecystitis papillomatosa.

five cases in which stones were present, there was no shadow of the dye at any time; in two, the stones produced a mottling of the shadow; in one, there was a faint shadow of the dye at the eighth hour only; in one, a constant faint shadow within which was the shadow of a stone, and in two, the responses were normal. Of fourteen cases of cholecystitis without stones, there was no shadow of the dye in eight, a shadow visible only at the fifth and eighth hours in two, and a shadow at the twenty-fourth hour

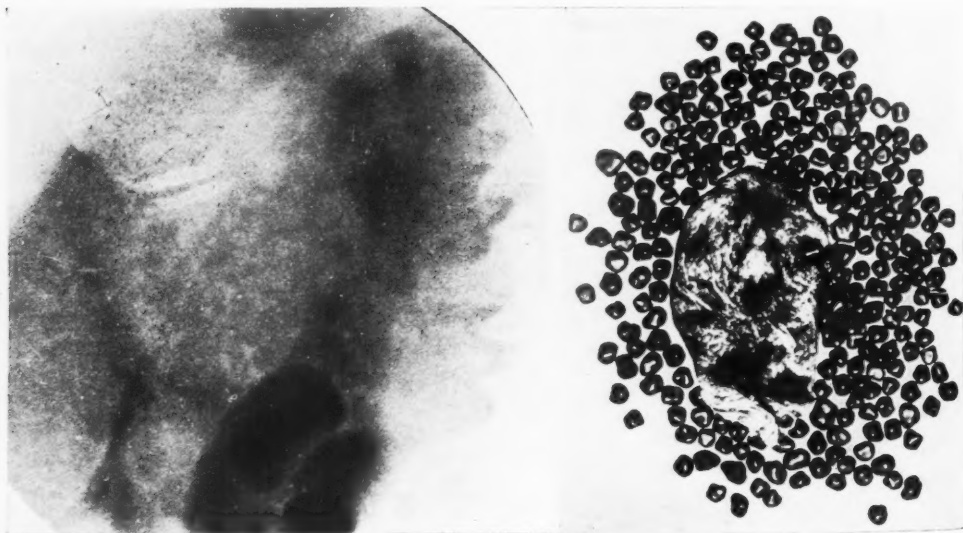


Fig. 4. Large mottled shadow of dye-filled gall bladder. The mottled appearance is due to a great number of stones displacing the dye. Photograph of specimen: chronic cholecystitis; multiple small stones.

only in one. In three cases the responses were normal.

Unfortunately, administration of the sodium salt of tetrabromphenolphthalein has certain disadvantages and contra-indications. Since it must be given intravenously, the technic is necessarily exacting. Though hospitalization of the patient may not be absolutely necessary, it is safer and therefore preferable. Phlebitis may result from injection into a vein of small caliber, such as the median cephalic. If the needle fails to enter the vein and dye is injected into the tissues, local necrosis and sloughing may occur. Systemic reactions from the dye are common, and vary from a slight malaise to most profound shock.

Reactions are so severe in certain conditions that the method is contra-indicated.

These conditions include obstruction of the common duct, extensive hepatic damage, marked diabetes, hyperthyroidism, arteriosclerosis, hypertension and cardiac disease, especially that attended with auricular fibrillation.

The position now held by the Graham method is much like that of the radiologic examination of the digestive tract in early days. The principle seems to be fairly established. The only problem is to make it safe, easy and routinely applicable. To do this, a non-toxic drug must be found which can be given freely, and, if possible, by mouth. With such a dye, I am confident that roentgenologic examination will become the chief reliance for the diagnosis of cholecystic disease.

Tuberculosis in childhood.—This report is based on a study of 165 cases. Fluoroscopic examination is never sufficient to establish a diagnosis. Next to sputum examination, a roentgenogram is of most importance. Up to the age of five the lung is pretty clean in a healthy child; later on, the roentgenograph is shadowed with past lesions. The hilum shadows produced by lymph glands, bronchial tubes, blood vessels, and connective tissue extend upwards to about the fifth rib posteriorly and downwards till they cross four ribs, width and density varying greatly in health. The lung fields show no markings in the outer zone, and, in the young, none in the middle zone.

The tracheo-bronchial glands, when diseased, form a shadow outside and parallel to the sternum, stretching from the clavicle down towards the hilum across the posterior second, third,

and fourth intercostal spaces. They are most commonly seen on the right side, as the aorta and other structures obscure the left hilum shadows.

As soon as disease extends from the intrathoracic glands to the lungs, infiltrating them, X-rays show its presence. Hilum tuberculosis shows first as an increase in the size and opacity of the hilum shadows; then the edges become diffuse, cloudy and indefinite. These may be spread along the interlobar fissures. Striated or lamellated shadows, following the contour of a lobe, are important; usually these begin near or at the hilus and radiate towards the periphery. Advanced and extensive tuberculosis is usually easily interpreted.

SOLOMON FINEMAN, M.D.

Pulmonary Tuberculosis in Childhood. John A. Watt. *Lancet*, Dec. 27, 1924, p. 1327.

TETRABROMPHENOLPHTHALEIN INJECTION AS AN OFFICE PROCEDURE¹

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WE first took up the tetrabromphenolphthalein method of visualizing the gall bladder a few weeks after the initial report of Graham and Cole in February, 1924. Our work is so arranged that if the method was to be of value to us it would have to be adapted to office use, and consequently it was with some misgivings that we reviewed the reports of reactions then following almost without exception the injection of the calcium salt.

However, after a few experimental cases had been run through at the City Hospital, we began to make the injections in the office, in cases in which, in spite of definite clinical grounds for suspicion of gall-bladder pathology, simple films of the region had failed to show any characteristic shadows. As soon as the sodium salt became available we changed to that preparation, which we have used since, and when it began to be sold in ampules we discarded the bulk salt and used a fresh ampule for each injection. We have had altogether fifty-four cases. This number is so small as compared with other series reported, and so few of the cases have subsequently been followed to the operating table, that this brief report will deal only with the availability of the method as an office procedure, leaving the questions of its ultimate value, and the minutiae of interpretation of variations in the shadows, to other workers whose material has been more voluminous and more closely checked.

The preparation of the patient has been simply that routinely followed for some years in preparation for ordinary gall-bladder roentgenography. It has consisted in a dose of licorice powder the day before examination, a cleansing enema of sodium bicarbonate solution the morning of examination, and the omission of breakfast. Unless plain gall-bladder films have already been made, these are made first, and devel-

oped and examined at once, as the injection is ordinarily reserved for patients who show nothing on simple direct examination.

The solution is prepared by dissolving one ampule (5.5 grams) of the sodium salt of tetrabromphenolphthalein in 55 c.c. of freshly distilled water, in an Ehrlenmeyer flask. This solution is sterilized in an ordinary office-instrument sterilizer, by standing the flask in the tray of the sterilizer for fifteen or twenty minutes with the water boiling. The solution is then made up to 55 c.c. again with sterile distilled water, filtered through sterile gauze, and allowed to cool, when it is ready for injection. It should be noted that each cubic centimeter of solution contains 0.1 gram of the dye.

The solution is injected into the median basilic vein of the arm, using an ordinary salvarsan syringe of 25 c.c. capacity, in two quantities of 20 and 25 c.c. each. Thus at the first injection the patient gets 2 grams and at the second 2.5 grams of dye. One must use great care to be sure that the needle is in the vein, and that it stays there, as the consequences of infiltration about the vein are very disagreeable, causing a slough and a sluggish ulcer which heals slowly. The use of a second syringe containing normal salt solution to which the needle is attached when entering the vein, and which is again connected to the needle after the injection is completed, to wash the remainder of the dye into the vein, is an excellent precaution, since the color of the dye solution offers so little contrast with blood that it is difficult to be sure that one is truly in the vein without the use of the second syringe.

It will be noted that, like others, we have reduced the total dose of dye from 5.5 to 4.5 grams. In many instances in which the reaction to the first dose was quite disagreeable, we have omitted the second dose altogether, and got quite satisfactory shadows

¹ Read before the Radiological Society of North America, December, 1924, at Kansas City.

with 2.0 grams only. However, where we did not get good shadows with the single 2-gram dose we did not feel that we were entitled to draw any conclusions from failure to fill, with so small a dose.

The first injection, particularly, is given very slowly, taking from five to ten minutes, and if the patient complains of any vertigo or distress, it is interrupted entirely for a few minutes. If the first injection does not cause any untoward symptoms, the second need not be given so slowly, as, in our experience, reaction comes during the first injection if it is to occur during either. The second injection is given a half hour after the first, the patient being allowed to remain on the couch where the first injection was given during this interval. Following the second injection the patient is allowed to go out if he feels well enough, being instructed to limit his lunch to fruit, or a green salad. Many patients feel so unwell that they prefer to remain on the couch until the four-hour film is made.

Routinely, we have made films at 4, 6, 24 and 30 hours after the first injection. We have found it useful to incorporate a figure or figures indicating the number of hours after injection, in the plate marker, as this prevents the possibility of the individual films in the series becoming mixed in the dark room or filing room. The same dietary restriction is imposed throughout the two days of examination; that is to say, the patient is instructed to limit his diet to fruits, cereals, and green salads. It is found that such an order is simple to give, and easily understood, and that it saves much talk, while insuring the requisite cutting down of the protein intake to a minimum without too much hardship.

From the purely roentgenographic standpoint, the method has been successful. That is, we have shown clear and satisfactory gall-bladder shadows—ones that the surgeon could see and understand without feeling called upon to make any remarks about the roentgenologist's imagination—in most cases where the clinical picture did not give reason to believe that there was adequate

pathological explanation for a failure to fill.

From the standpoint of diagnosis, I believe the principal value of the method to us has been in establishing as normal—according to the accepted criteria of the test—certain gall bladders which, from the clinical standpoint, were under strong suspicion. The type of case to which I refer is the rather common one with a long history of vague gastro-intestinal symptoms, in which ulcer has been practically excluded and in which simple films of the gall bladder are negative. The internist feels that the gall bladder is the most likely seat of trouble, but wants all the information he can get before recommending surgical treatment. In several cases of this sort a perfectly normal performance following the dye injection has led investigation into other channels. In three such cases our impression that the gall bladder was normal has been confirmed at operation, the pathology being found in the appendix.

As we have gone along with the work our tendency has been more and more to classify the findings simply as normal and abnormal, without being very enthusiastic about any attempt to deduce the exact cause of a failure to fill and empty normally. We have had complete failure to fill in four or five instances in which there was at least no clinical basis for a suspicion of advanced gall-bladder pathology, and in which the full amount of the dye had been injected (5.5 grams). On the other hand, we have had, as indicated, satisfactory shadows with only 2 grams of dye injected. One wonders just how often a failure to show a good shadow may be due to trouble in the liver itself, and if such trouble need be so very advanced to prevent normal excretion of the dye substance under certain circumstances. We have not been fortunate enough to show any stones by this method that had not been demonstrated without it.

However, any just estimate of the value of the method will in the end have to depend on reports of the character of Carman's excellent article in the *American*

Journal of Roentgenology and Radium Therapy of November, 1924. Tabulations of relatively large series of cases with surgical check on the diagnosis will make more or less speculative inferences superfluous. For the present I think there can be no question that the method has value, and a future. We have been much in need of a more accurate method in gall-bladder diagnosis, and if, when presented, it has some drawbacks, that fact need discourage no one.

At present the principal drawbacks seem to be—from the point of view of the office worker—the technical complexity of the procedure, and the frequency and severity of the reactions. From the technical standpoint the whole proceeding may be fairly compared to the injection of two doses of old salvarsan. The preparation of the solution and the patient, and the performance of the injection, call for about an equal degree of care and skill. If the method is to be used routinely in the office there must be available dressing rooms with couches, so that the uncomfortably ill patient can be kept in the office during the first few hours after the injection. We have felt no uneasiness about allowing the patients to go home after the 6-hour film, as none of them has been worse than slightly uncomfortable at this period.

The reactions, while much less marked with the sodium salt as put up in ampules than with either the calcium salt or the bulk sodium salt, are still a factor to be reckoned with. In the more recent cases, using the smaller (4.5 gram) dose we have had very little nausea and vertigo. However, some

degree of vasomotor reaction has been quite the rule. The patients experience a sense of constriction in the chest, difficulty in breathing and quite severe pain in the upper abdomen, or in the back at the lower dorsal level. This usually comes on shortly after the first injection and is not usually much accentuated by the second. In some instances it has been delayed, coming three or four hours after injection. As a rule, it does not last very long, but it does seem to leave the patient feeling weak and shaky for some hours. We have not been apprehensive of serious trouble from any of these reactions, although we did have one which simulated a severe anaphylactic reaction with large urticarial lesions accompanying the dyspnea and sense of constriction, quite alarming to the patient. In no case has there seemed to be any bad after-effect. We feel, then, that while the performance is somewhat exacting and time-consuming, and while it interferes a good deal with office routine, it is quite justifiable to use it as an office measure whenever hospitalization is impracticable.

That it will be generally used as an office procedure, with the present technic, we very much doubt. The ideal variant of the method would be, of course, a non-toxic dye which could be administered by mouth, and which would give equally good shadows. Still, could the reactions be cut to the present minimum, with a dye which, while still adapted only for intravenous use, could be given in a single injection, such a modification should remove all the important objections to the method for office use.

Pulmonary tuberculosis.—This is not a rare disease of infancy and early childhood, but the clinical course is somewhat different from the same condition in adults. The course is long and chronic, but not necessarily fatal, and the disease may clear up entirely. Every frail child must not be hastily pronounced tuberculous, but, on the other hand, one must remember the frequency of its occurrence and carefully examine every suspected child. Nothing new is offered for treatment. The hilum structures are the

most frequent focus from which the lungs may be infected again and again. One must not be overzealous and neglect to eliminate other chronic infection, but, after this is done, no hesitancy should be felt in diagnosing tuberculosis when clinical symptoms warrant it.

B. C. CUSHWAY, M.D.

Pulmonary Tuberculosis in Childhood. F. G. Chandler and T. W. Preston. *Brit. Jour. Child. Dis.*, March, 1925, p. 1.

DIFFERENTIAL DIAGNOSIS OF GALLSTONES AND KIDNEY STONES ¹

By BERNARD H. NICHOLS, M.D., Department of Roentgenology, Cleveland Clinic, CLEVELAND, OHIO

AS my contribution to this symposium I shall attempt to review and emphasize a few of the practical points which we have found valuable in the differential diagnosis of calculi of the gall bladder and of the kidney.

Of prime importance is the appearance of the shadows. Gallstones usually produce more or less clearly circumscribed shadows. Many of them have an outer layer rich in calcium salts which gives a ring-like shadow with a more or less translucent center. In many cases, however, shadows are homogeneous and cannot be differentiated from the shadows of kidney stones. Gallstones are more often multiple than are kidney stones, their arrangement

corresponding to the shape and location of the gall bladder.

Kidney stones, on the other hand, are usually irregular in shape, their form often corresponding to that of the kidney pelvis or calices; or in some instances the stone may fill the pelvis and have branches which extend into the calices. The shadows of kidney calculi are almost always of a homogeneous density which is quite unlike the typical gallstone shadow.

In a fairly large percentage of cases, however, calculi cannot be identified by the size, shape or general appearance of their shadows, and in such cases specific means of differential diagnosis are required. The method which we have found of the great-

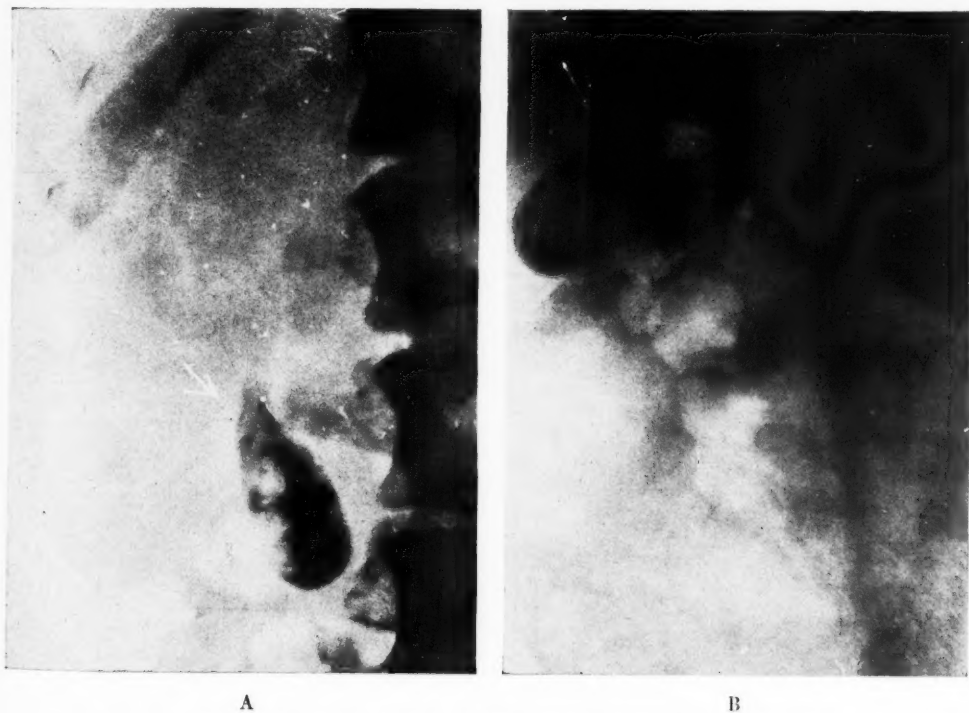


Fig. 1. Pathological gall bladder containing stones as shown on (a) posterior-anterior and (b) anterior-posterior films.

¹ Read before the Radiological Society of North America, at Kansas City, December, 1924.

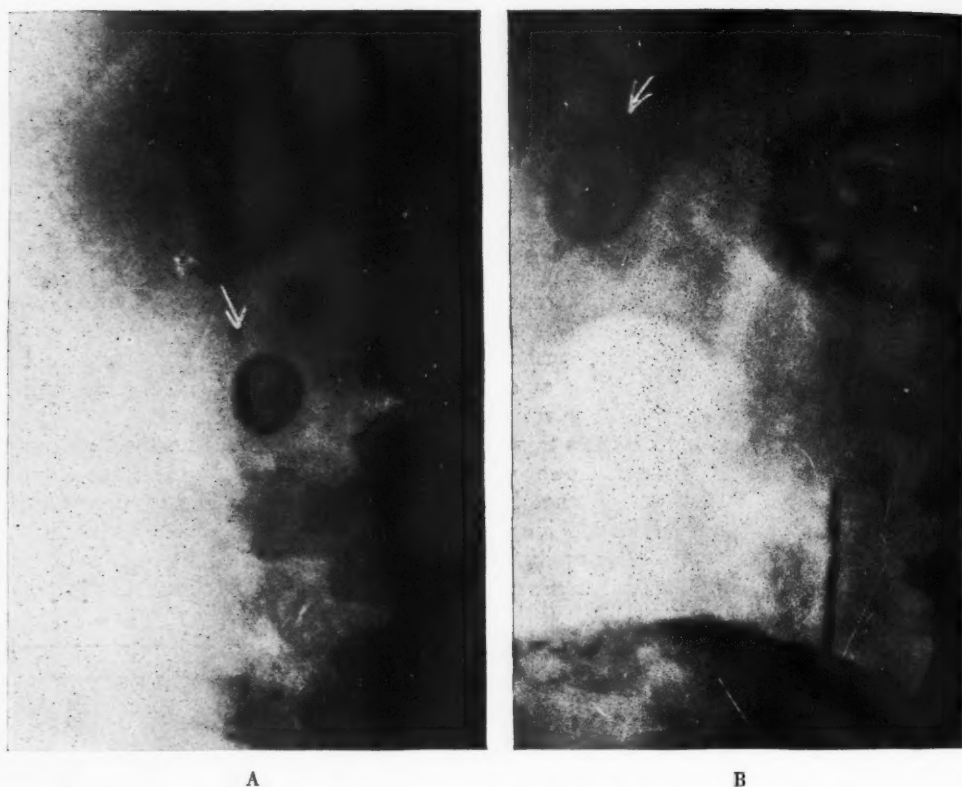


Fig. 2. Relative positions of gallstones on (a) posterior-anterior and (b) anterior-posterior films.

est value is the use of the anterior-posterior and posterior-anterior exposures in accordance with the principle used in the localization of foreign bodies. The greater the distance of the foreign body from the film, the greater will be the size of the impression on the film. This method is of especial value in the examination of rather fat individuals, as in such cases the shadows of gall-bladder calculi lie at a considerable distance from the film in the anterior-posterior position, so that they appear much larger than on the films taken in the posterior-anterior position.

In general, then, we may say that when the shadow of a stone on the posterior-anterior or gall-bladder film is smaller in size, more distinct in outline, lower in position and nearer the vertebral column than the shadow of the same stone in the an-

terior-posterior or kidney film, the diagnosis of a gallstone may safely be made.

However, the criteria cited above may not suffice to establish the diagnosis in certain cases. This is especially true in the case of a thin individual, when certain other methods must be utilized in order to make the differential diagnosis.

We have found that the most valuable of these auxiliary measures are pyelograms made after the injection of either a full strength (17 per cent) solution of sodium iodid, which, in the case of a kidney calculus, will locate the shadow in the pelvis of the kidney, or of a 5 per cent solution, by means of which the kidney pelvis can be well outlined and the calculus can be seen on the pyelogram in the pelvis or calyx of the kidney. In the case of a gallstone, the shadow on the pyelogram will almost al-



Fig. 3. Relative positions of gallstones on (a) posterior-anterior and (b) anterior-posterior films

ways lie outside the kidney pelvis. If it also lies outside the kidney in either the gall-bladder film or the kidney film a calculus in the pole of the kidney will be ruled out, as a stone in this location must of necessity be associated with the kidney shadow in all exposures. It should always be borne in mind, however, that a patient may have both gallstones and a right kidney calculus.

There are also a few cases in which right-sided pain is caused by stones which do not appear on either the gall-bladder or the kidney films. In such cases, kidney calculi in the kidney pelvis or in a calyx of the kidney may be shown on a pyelogram of lesser density.

Finally, but by no means of least importance in the differential diagnosis, are careful roentgenographic studies of the pyloric end of the stomach, of the duodenum and of the hepatic flexure for direct or indirect evidence of gall-bladder disease.

SUMMARY

To summarize then, I would say that from the roentgenographic standpoint the criteria for the differential diagnosis of gallstones and kidney stones, in the order of their importance, are the following:

1. The size, shape and appearance of the shadow of the stone.
2. The appearance of the shadow on the posterior-anterior as compared with anterior-posterior film.
3. The location and appearance of the shadow as defined by pyelographs of the right kidney.
4. The appearance and behavior of the gall bladder as defined by the shadow of an opaque medium in the stomach, the duodenum and the hepatic flexure of the colon.

DISCUSSION

DR. SHERWOOD MOORE (St. Louis): First, I wish to congratulate the speakers on the beauty and excellence of their work.

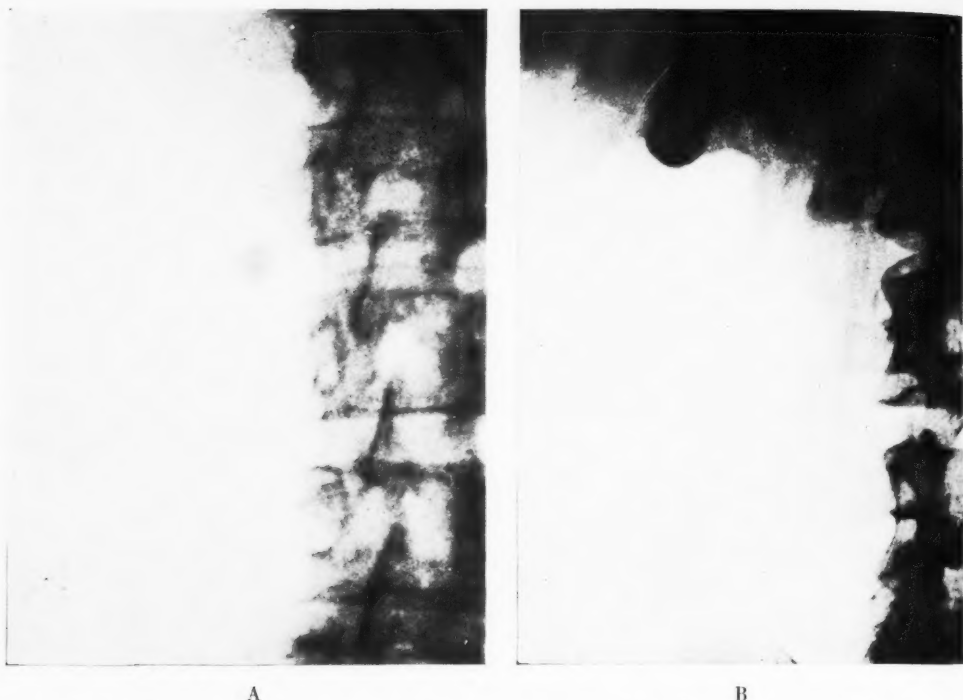


Fig. 4. Relative positions of gallstones on (a) posterior-anterior and (b) anterior-posterior films.

Recently I have gone over the operatively confirmed cases of cholecystic disease occurring in the Barnes Hospital, in St. Louis, during an eight-year period. In that time, I find that somewhat less than 50 per cent of the operatively confirmed cases ever had an X-ray examination. This means that all the cases of cholecystic disease that were frank, were immediately operated on. In those having an X-ray examination, it was done as a part of the examination for confused, or not clear, alimentary tract disease. In that number we found a certain proportion of stones, which were reported as such. The percentage of correct diagnoses of stones was, I believe, 97; it was over 95 at any rate. A somewhat larger number of cases, examined by X-ray, were operated on and were found to have gallstones. Taking the figures all around and including those cases in which the diagnosis of pathological gall bladder was made through the demonstration of the presence of stones and the secondary signs of gall-

bladder disease, our percentage of correct diagnoses, by X-ray examination, over the eight-year period, is, I believe, 37.5. Since we have been employing the method of Graham in making cholecystograms, we have found that by combining clinical histories with the cholecystograms, we may obtain 100 per cent correct diagnoses of pathological gall bladders.

The most important point in the interpretation of cholecystograms, I think, was touched on by Dr. Carman. It is certainly true that in our work a faintness of shadow, or absence of shadow, in the order of their importance, with late filling and constancy of outline, are prime factors in establishing the diagnosis. Our operative cases are now somewhere between 40 and 50 and, as I said, we have come out virtually 100 per cent correct. Like Dr. Nichols, I do not care to use percentages, especially in medicine, when they run up above 60 per cent, but that has been our experience. Dr. Arens dealt with what he called the sheath,



Fig. 5. Relative positions of gallstones on (a) posterior-anterior and (b) anterior-posterior films.

antral or duodenal impression from a filled gall bladder. As far as we have gone in this work, we have unmistakable evidence that that is a frequent finding in normal individuals.

One point, which Dr. Nichols brought out, I should like very much to endorse; that is, as I sensed it, the importance of taking pains in gall-bladder examinations. Whatever may be developed of the cholecystography, the older method must be carried out with an exact technic, as a preliminary to the injection method. I believe, by so doing, that a high percentage of gall-bladder disease, as registered by the demonstration of a thickened gall-bladder wall or stones, will be brought out. If so, it is not necessary to proceed with the tetabrom injections, which are somewhat of a strain on the patients. I may say here that, so far as the reaction is concerned, it seems to me it is less trying, in the long run, on the patient, than pyelography.

The interpretation of cholecystograms is quite difficult and I am not, at present, prepared to go much farther than was Dr. Car-

man in what he had to say. We are finding some very interesting things. Among them is the fact that frequently the surgeon, with the gall bladder before his eyes and in his hand, will not recognize the fact that it is diseased. A cholecystogram will show no gall-bladder shadow present; where that occurs and you are reasonably sure of your technic, that gall bladder should be removed. We have had several cases in which we have found extensive cholecystic disease when the organ was opened, without any material thickening of the walls.

I would like to show the slides of three cases. This is the gall bladder of a patient which gave no shadow on cholecystography. On the right is a photograph and on the left is a radiograph of the excised gall bladder. You will see that the stones were there; in the photograph you can see the impressions on the wall, but there was no shadow present. You will also note that those stones varied in tone only slightly from the surrounding media. This is the photograph of the gall bladder, after opening, with multiple stones and a thickened mucosa, of the

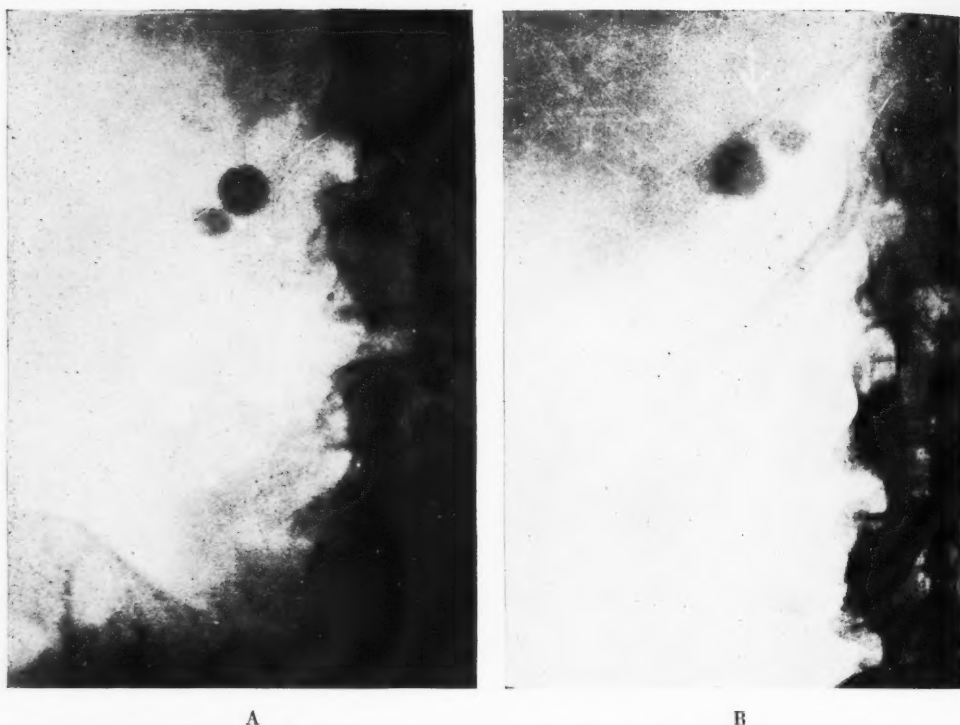


Fig. 6. Relative positions of gallstones on (a) posterior-anterior and (b) anterior-posterior films.

primary type. The specific gravity of these stones was 1.034, which approximates the figure for the lower range of specific gravity for the bile. I do not believe, with the most exact technic, that those stones could be demonstrated on the ordinary X-ray examination and that is the occasion for showing this case. I hesitate to show the next slide. This patient came in with a history of cholecystectomy some two years before. Up under the spinal end of the twelfth rib there was a very faint, round shadow. In view of the fact that the shadow was present and was, at the same time, thin and faint, we interpreted it as being a pathological gall bladder, in spite of the history. It was a definite case; there was a gall bladder and it was diseased. This is the excised gall bladder, which has a thickened wall and a diseased mucosa. You will see that the fundus is square-cut, this resulting, undoubtedly, from an amputation at that point. This next case was a very recent

one. No shadow was present at any time. At operation the gall bladder looked perfectly normal; was soft and flexible, but in view of the fact that we had secured no shadow, I urged Dr. Cole, who was in this work, to take it out. He did so, I think perhaps with some doubt, and on opening it he found that there was inflammation of the mucosa and, down at the cystic duct, there was a small dark spot that projected from the ampulla and was surrounded by edematous mucosa. This dark spot was the edge of a small stone obstructing the duct.

The findings which are secured by ordinary X-ray examination are necessarily the product of disease which has been in existence for some time. Stones, for example, or a fibrous gall-bladder wall. Personally, I do not believe that there is any such thing as "silent" gall-bladder disease, in spite of the fact that 5 per cent of the autopsies do show gallstones or gall-bladder disease. I believe that those patients certainly have

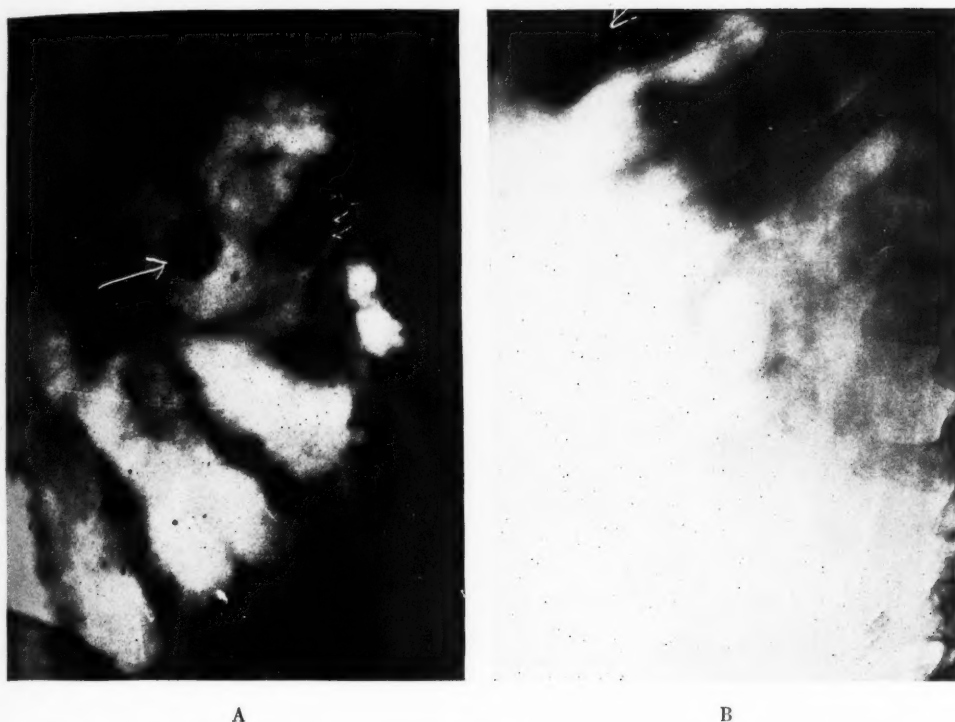


Fig. 7. Relative positions of gallstones on (a) posterior-anterior and (b) anterior-posterior films.

had their efficiency impaired by the existence of such changes as we find. Someone has said that cholecystic disease is a disease of the young, with middle-aged manifestations. I think it is important that this affection should be corrected at its beginning. At Barnes Hospital we hold to the hypothesis that the proper treatment for these conditions is surgical removal. I think we have at hand a method which certainly promises to detect cholecystic disease in its very beginning.

DR. I. S. TROSTLER (Chicago): I would like to ask Dr. Arens a question. Is not the case that Dr. Moore, of St. Louis, showed, where the gall bladder had been amputated, a demonstration of what Dr. Daniel Eisendrath tried to show us at the American Medical Association meeting in New Orleans in 1920, of the regeneration or partial regeneration of the gall bladder after amputation, where an ampulla was formed?

We have not had a demonstration of that yet in the human. Dr. Moore told about the case of cholecystectomy in which he showed a gall bladder afterwards. Do you get the point, Doctor? It has never been found in a human before until this case. I would like to know what you think of it.

DR. M. N. GARHART (Seattle): I think that these papers are very important and they throw considerable light on a subject that heretofore has certainly been a dark one, at least in my own experience, and I feel that a great deal of credit is due the men who have presented these papers. I agree with Dr. Moore on his report of the diagnosis of our interpretation of shadow findings as being of value. In seven years of experience as a pathologist in a large hospital, where I had a chance or was called upon to view gall bladders *in situ* and to pass an opinion on a great many, I found no one characteristic appearance that could

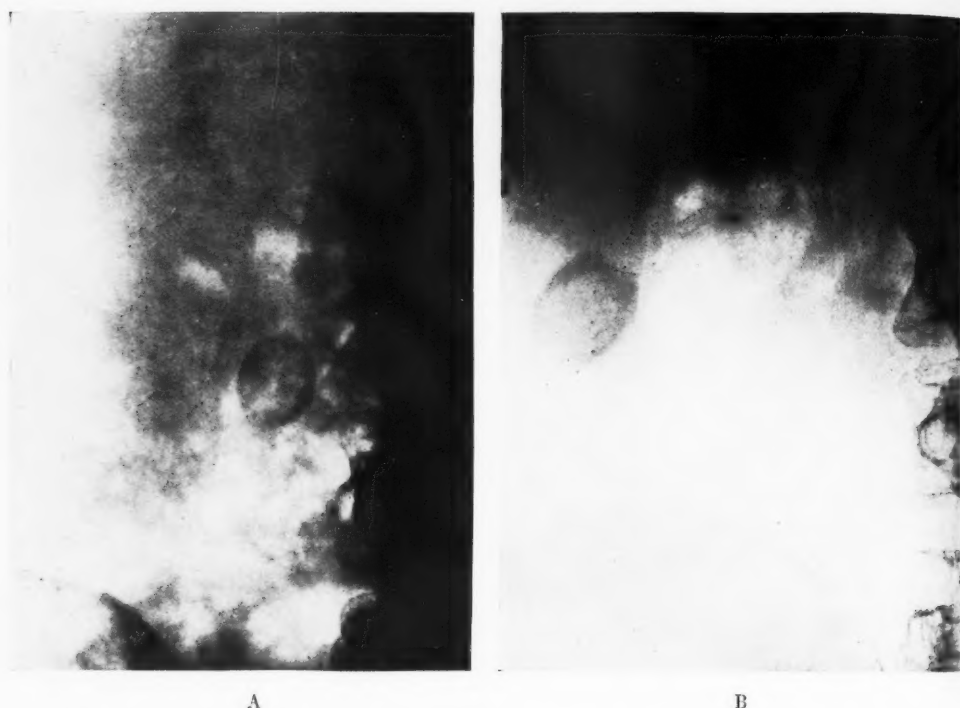


Fig. 8. Relative positions of gallstones on (a) posterior-anterior and (b) anterior-posterior films.

be absolutely diagnostic; for instance, to see a gall bladder *in situ* and to say whether or not it should be removed. I think the findings have been similar at the Mayo Clinic, where the roentgenologist visits the operation to observe the findings. I think that Dr. Carman's report of the Graham method is most valuable. It shows, as was confirmed by Dr. Moore's opinion, that a step forward has been made. I might add one thing, also emphasizing what Dr. Carman brought out, that there are contraindications to the use of this method and we should know these. I have seen one case of shock in a patient who was hospitalized, and who was very sick, evidently due to toxic changes; for a time it looked as if he was going to die. I also know that the preparations differ. I do not know why a preparation of drugs manufactured by one company should differ from that of another company, but it does, as has been proven by men who have been using this method.

The technic in the administration—whether it is given in a single dose or in two doses or three doses—has also been brought up. Recently, when I visited Dr. Sante in St. Louis, he told me that by dividing the doses and using two doses instead of giving it all in one, the toxic changes were less and he and his fellow workers felt it was much better.

I want to commend Dr. Moore on his honest report of surgical findings. I think that we all feel the same way when we have checked up our X-ray findings with the surgeon.

DR. H. J. ULLMANN (Santa Barbara): I want to answer Dr. Darling's remark about hand-picked patients. There was a nurse in the Cottage Hospital who had a typical gall-bladder syndrome. It was diagnosed as gall-bladder disease not only by the internists, but by the consulting surgeon, and they wanted to see if we could

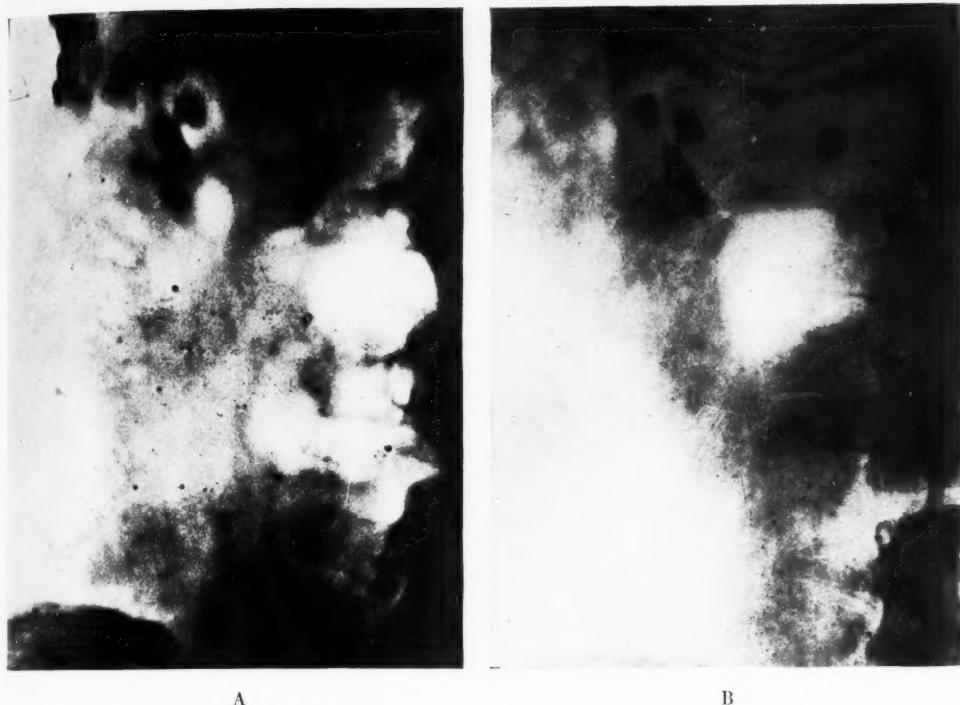


Fig. 9. Relative positions of kidney stones on (a) posterior-anterior and (b) anterior-posterior films.

show it. I showed a gall bladder distinctly enough for me to come out flat-footedly in writing that there was a gall bladder there, and I called it a pathological gall bladder. She came to operation. Dr. Lucius Hotchkiss, formerly of New York, reported that it was perfectly normal and he did not feel justified in removing it. A chronically inflamed, retrocecal appendix was removed and the girl has been well for a year. I am not sure that even in hand-picked cases a visualized gall bladder is necessarily a diseased one.

DR. C. W. GEYER (Milwaukee, Wis.): This gall-bladder proposition, of course, is the same to-day as it always has been with the average X-ray man: I think we all have difficulty in showing gallstones under ordinary conditions. With the exception of a few men like Dr. Arens, perhaps, who seems to have displayed particular ability in radiating gallstones, and Dr. Nichols,

whose technic is equally as good,—particularly good if we wish to differentiate gall from kidney stones,—most of us have had difficulty in showing gallstones. The Graham technic has been mighty welcome. I was very glad to have heard Dr. Carman and to have known of Dr. Carman's kindly feeling towards this Graham technic, because it seems to me that remarks from a man like Dr. Carman are certainly worth a good deal to us. My interest in this dates back almost to the origin of the administration of the dye for the demonstration of the gall bladder, some nine months ago, and at the University Hospital in Milwaukee we have run through some fifty or sixty cases. I should like to recite at least one of the reasons why more men have not taken up this method of demonstrating the gall bladder. It is undoubtedly because of their fear of the results of this particular dye and their lack of knowledge of interpretation of the plates, after they have



Fig. 10. Relative positions of kidney stones on (a) posterior-anterior and (b) anterior-posterior films.

them, and probably a question as to the value of their interpretation. I think this technic has come to stay and I want to give you my experience in these fifty or more cases.

Our first cases were given the sodium salt of tetrabromophenolphthalein, which comes in two-ounce bottles and was purchased from the Mallinckrodt Chemical Co., of St. Louis. We found that this dye became more toxic as we used that toward the bottom of the bottle, so that at the present time we are using the dye put up in five and a half gram ampules, which is the usual dose for a 150-pound patient. The first case which I injected was given according to the instructions in the little paper which comes in the package, in which you are told that the stomach and duodenum must be empty. I figured it would be well to give the preparation which we give to gastro-intestinal cases,—a dose of oil the night before, with no breakfast,—and then to administer this

drug in two doses of 20 c.c. each, half an hour apart; that is, dissolving this dye in 40 c.c. of triple distilled, recently sterilized water, or sterilizing after the dye has been dissolved in water. We gave this in two doses and in the very first case in which I gave it we obtained a beautiful shadow of a gall bladder, and I was well satisfied with the result. After that we ran through three or four more cases with questionable results. I was unable to interpret these plates and sent them to Dr. Graham, at St. Louis, and he kindly invited me to come down and see their technic and offered to assist me in interpreting my plates. I cannot praise too highly the courtesy of Dr. Graham and his willingness to show any one willing to go to Barnes Hospital at St. Louis and learn their method of giving this dye. In talking this over with Dr. Graham, the only error in our technic seemed to be in the fact that we were giving the oil the night before. He felt that there was some peristaltic action

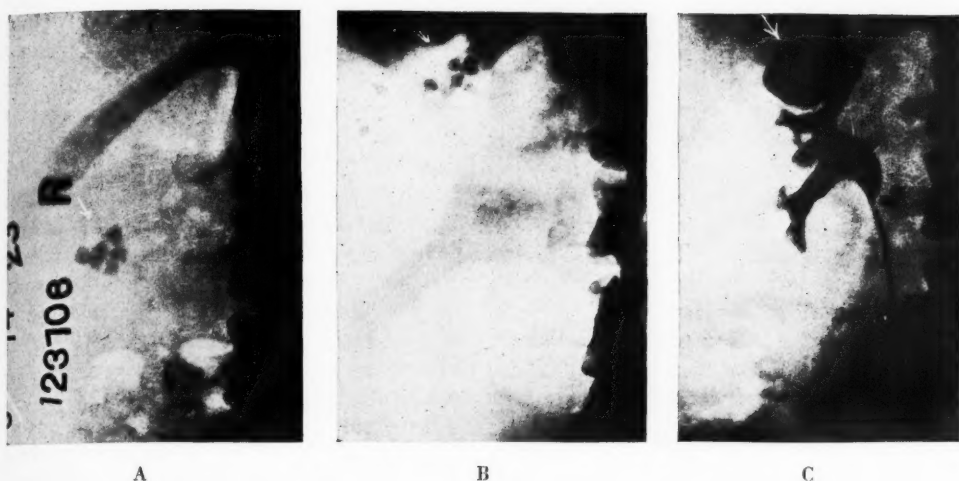


Fig. 11. Kidney stones: (a) posterior-anterior film, (b) anterior-posterior film, and (c) pyelogram.

in the gall bladder and the probability was that the gall bladder was emptying the bile and not retaining it as it should; so we went back and started a series of half a dozen more cases. Then the thing we contended with was the fact that we had not emptied the bowels of the gas in the hepatic flexure. This gas seemed to come on about twenty-four hours after our test started and interfered with the twenty-four-hour and forty-eight-hour plates very materially. We then conceived the idea of giving a gas-free meal—as far as possible. Now we give a cooked cereal for about three days before, and our results are very much better than they were in the beginning. The technic is something as follows: This cooked cereal is given for three or four days before the patient comes to the hospital; there is no oil given, no laxative of any kind. He comes into the hospital on the morning of the examination and becomes hospitalized for at least twenty-four hours. In order to avoid any error, we always take a plate before the dye is injected. I remember Dr. LeWald's criticism on one of our original reports, in that a gall bladder might show up without this injection, so we take a plate before the injection is made. We then give this dose of aniline dye in 40 c.c. of triple distilled, recently sterilized solution by the *gravity*

method. We feel that it accommodates itself better to the condition of the patient than by injection from a syringe, and we give it all in one dose. I cannot be too particular in cautioning you that every particle of this solution must be introduced into the veins in order to avoid any trouble. We have two gravity tubes with two-way cocks, one filled with normal salt solution, the other with dye solution. The solution is injected in the usual way of giving an intravenous; that is, the needle is introduced into the vein and allowed to bleed. We then introduce a little normal salt solution to be sure that we are in the vein. We next run in this 40 c.c. of the dye, taking ten to fifteen minutes, and then wash out the vein with normal salt solution. We then start to radiate the patient, a plate at five hours or at four hours, at six hours, eight hours and, usually, a ten-hour plate and a twenty-four-hour plate.

We ran through about a dozen normal cases and found that in the normal pictures we got a beginning shadow at about five hours. The size of the gall bladder reaches its maximum at about six hours, and in the eight-hour plate of the normal subject, the size is smaller and more dense in shadow. It is almost completely emptied at twenty-

four hours and completely so at forty-eight hours.

We have had some bad results in local irritations, because the injection was given by the attending physician or surgeon. For that reason we do not permit any one to give these injections except the interne or house physician, who is instructed in every detail of giving them. These local irritations will produce sloughs far greater than any I have seen from salvarsan. The chemical is highly irritating to the soft tissues, and, in order to avoid this, be sure that the needle is introduced directly into the vein and that none of the material gets on the outside. In order to overcome the possibility of phlebitis, which we had in one or two of the early cases, we wash the vein out with normal salt solution.

So much for the technic; the next idea will be the interpretation of these plates. This knowledge comes only from repeated experience, and from examination of great numbers of series of plates. I believe you are perfectly safe in using this method. I am sure Dr. Graham would be very grateful to any of the men who have had experience with this method of demonstration of the gall bladder who are willing to send in their reports, because he is anxious to get reports from various men who are using it. We have had no bad results from general toxic condition, except some malaise that developed and disappeared early. I do not know that there are any contra-indications. If there are, we have not watched for them. We have felt that if the dye does not escape into the soft tissues, that if we wash out the vein with normal salt solution to avoid phlebitis, and that if the gravity method instead of the syringe is used, there is little danger. Surely, no deaths have been noted to date. Of course, the patient should be hospitalized.

DR. W. H. WALLACE (Brooklyn): There is just one little point so much at variance with my own experience that I want to speak about it. One of the doctors referred to the stasis in the stomach in his gall-blad-

der cases. I have never seen stasis from a gall-bladder condition unaccompanied by some other complication. We make our diagnosis in most of the cases by reflexes that we find in the stomach. With the duodenal ulcer the reflex emptying the stomach makes it much more rapid than from any other cause; if from gall-bladder condition, it comes second. If you have a stomach that empties in four hours it may be a gall bladder or a chronic appendix. If it empties in two and a half or three hours, in all probability it is a case of duodenal ulcer.

In a survey of all the abdominal cases that came to the X-ray Department over a period of four years in the Methodist Episcopal Hospital, a check-up by the surgical division showed that the X-ray diagnosis was confirmed at operation in a little better than 90 per cent of the cases operated on; this in a 300-bed hospital. Now that is a result not to be lightly cast aside. It has always been easier for me to follow the reflexes of the stomach than to find the incisura about the pylorus, and easier than to find gallstones in most cases.

Why the Doctor should find stasis in most of his gall-bladder cases I cannot understand, for my experience is the direct opposite—nearly every case showing hypermotility where there were no obstructing adhesions.

DR. ARENS (closing): I would like to say a word about tetrabromphenolphthalein in answer to Dr. Carman, Dr. Moore, and others. I do not believe it is a question so much as to whether we use tetrabromphenolphthalein or the straight roentgen method, such as we have used at Michael Reese Hospital. Tetrabromphenolphthalein stimulates liver conditions. As to whether normal gall bladders will produce a gall-bladder seat, I doubt it. We have seen no proof that a tetrabromphenolphthalein gall bladder that produced a gall-bladder seat, produced one without it. It seems we are losing sight of our physiology and I would offer a suggestion to the men

who are using this work. I think it is a wonderful thing; I myself believe that ultimately we will all come to it, but as stomachs empty in two and a half hours and they are normal, as they empty in six hours and are normal, as colons empty in twenty-four hours and are normal, and as they empty in forty-eight hours and are normal, why should the gall bladder empty or fill in a specified time? Let us go back to the work of our departed colleague, Dr. Mills. He laid down the laws by which gastrointestinal problems are worked out to-day as far as the functions of the stomach are concerned, taking into consideration the physical type of the patient, the type of stomach that belongs with that patient and the emptying time of that stomach in relation to the physical type. The heart, the chest, the abdomen, the colon all play their parts; they all bear an intimate relation, one to the other. I would suggest, if I may, that, for instance, Dr. Carman and Dr. Moore utilize their facilities, run through a series of normal individuals, group those individuals according to Mills' classification, and see what the emptying time of the gall bladder will be in those cases. We can draw our conclusions afterwards.

As to Dr. Darling's operation, I can laugh too, that any medical man has the nerve to tell us as roentgenologists that we insist that the patient go to operation because he shows a gallstone. Of course, it may be one of the oldest member's privileges to "put us on the grid"; at the same time, that question is unfairly raised; not only in this meeting, but by surgeons, internists, etc. We have to realize that we play a part in the ultimate diagnosis of the condition of any patient, and since we play that part we do not say this patient shall be operated on and this one shall not. If that patient comes to me clinically I will examine that patient clinically and will base my diagnosis on every known clinical and laboratory method possible. As to Dr. Trostler's question regarding the regeneration of the gall bladder after operation, I can only answer that in this way: I have

had occasion to ray a patient who had had a cholecystectomy and I found a gall-bladder shadow. A second operation was done by Dr. McArthur, not on the roentgen findings alone, but on the clinical findings, correlating the roentgen findings into them. This particular case, when operated upon, disclosed the upper surface of the liver to be completely covered over with adhesions and no gall bladder could be found. We could not explain the shadow, so he finally decided to cut through those adhesions—and found a gall bladder under them, leaving an imprint in the liver. Now as to whether that gall bladder was removed primarily or not, I doubt it and have always chosen to believe it was not a regenerated gall bladder, but a case in which the patient had been operated on and told that the gall bladder had been removed, when it was not.

I would like to call your attention to one thing that Dr. Geyer mentioned, namely, the fact that castor oil will stimulate the gall bladder, will cause the gall bladder to empty. He makes that remark as having come directly from Dr. Graham. That is significant, if true, and for my purposes I am willing to concede that it is true, for then a normal gall bladder will have emptied by the time we do our gastro-intestinal work and, therefore, should produce no gall-bladder seat or pressure in any portion of the gastro-intestinal tract. A collapsed gall bladder will not do that. But if that gall bladder fails to empty, we have an analogous situation to what we have with the tetrabromphenolphthalein, only in this case it must be pathological. If it empties according to the action of a cathartic, we would not find it. If it remains filled, it should be pathological. I still maintain that a gall-bladder seat is an indication of pathology of the gall bladder, and am willing to change my mind when it has been proven the other way around.

As to Dr. Wallace's statement regarding stasis of the stomach, I believe Dr. Wallace misunderstood me. I made no mention of stasis of the stomach; I mentioned stasis of

the duodenum. I fully agree with his remarks regarding the emptying of the stomach, but my remarks in the paper were made regarding duodenal stasis, with regurgitation to and fro, sometimes back into the bulb.

The question as to diet might be worth considering and possibly more work along that line will bring further light. I feel, as a whole, that the tetrabromphenolphthalein method is a distinct advance, but have not yet found it necessary in the majority of cases. If we can run, as we have done, up to 88 per cent of the definitely controlled cases, I am perfectly willing to use the tetrabromphenolphthalein at the present time as an adjunct and do away with the discomfort these patients are put to. Again, it may be that I will change my mind entirely and be perfectly willing to go over completely to the new method. Dr. Geyer's method offers a wonderful possibility, that is, of taking some gall-bladder films before the injection of tetrabromphenolphthalein.

DR. CARMAN (closing): There is not much I can add. I quite agree with Dr. Moore and Dr. Geyer in their deductions from this work. I might say that the responses, both normal and abnormal, as we have catalogued them, may have to be changed with added experience. We have to add some and subtract others; they are not final. In regard to secondary signs, I do not mean to say they are not present in gall-bladder disease; we see them and they apply to-day, but they won't apply to-morrow; you cannot rely on them in routine work, and I think this is worth while keeping in mind. I would also like to ask Dr. Arens how he would determine whether the case is normal or not in making a study with the barium test? I do not think it would be wise to operate to find out whether the patient was normal, and we certainly know that many persons have gall-bladder disease, both stones and cholecystitis, not known before they are opened up for something else; so it would be very hard to select a group of normal cases to try this method on.

DR. ARENS: The only way I can suggest would be to take certain patients that are nearly normal, that are as near normal as one can determine, considering the history, etc. The weak spot in that, as Dr. Carman has pointed out, is the same weak spot that we have in our practice, but that is the only way to finally come to a conclusion as to what constitutes normal and what does not. I agree with Dr. Carman as to the difficulty of showing absolutely normal cases.

DR. NICHOLS (closing): I want to subscribe most heartily to cholecystography because I feel that by this method a better study of gall-bladder disease can be made in selected cases than by any other. But I still feel, as in the investigation of the kidney, that an exhaustive study of suspected gall-bladder disease should first be made by the more simple methods. I want to apologize to Dr. Darling for irritating his nervous system by quoting percentages. I did this to show what a large number of gallstones removed at operation in our clinic had been definitely shown on the films before operation, so that a correct pre-operative diagnosis was made. I realize that this percentage may not mean a great deal, because if a certain surgeon operated only on cases in which a diagnosis had been made on the basis of definite gallstone shadows on the films, then 100 per cent of his cases would have visible stones; but the series which I reported were taken from our records of patients who had symptoms of gall-bladder disease and the diagnosis was made according to our routine method.

In answer to the question regarding the making of direct prints from gall-bladder films, we have never followed this procedure. We use only the ordinary duplitized films, being careful in the selection of our screens, which are absolutely tested for contact and are used for no other purpose than for the gall bladder. The development of the plates is carefully supervised and we feel that this attention to detail aids us greatly in picking up many gall-bladder shadows. All of our work is done with the

Bucky diaphragm. After checking those cases in which stones were not shown on the primary film, by means of a water phantom of depth equivalent to the size of the patient, we found that many cases were be-

ing missed on account of movement of the gall bladder during a slow exposure. Consequently, at present, we are making at least one film without the Bucky diaphragm, with an exposure of a tenth of a second.

Massive pulmonary collapse.—Roentgen-ray examination of cases of massive pulmonary collapse invariably shows that the diaphragm on the affected side is raised, often to a higher level than that reached in the extreme expiratory position. It has even been seen to move in the reverse direction, rising with inspiration, owing to the increase of intra-abdominal pressure from the descent of the unaffected lobe. Moreover, frequent opportunity was afforded during the war of observing the diaphragm through a hole in the chest wall, and the atonic, flaccid condition of the muscle was obvious.

Why the diaphragm is paralyzed in these cases is a question still under debate. The writer and Alexander are of the opinion that it is a reflex paralysis phenomenon, the afferent impulses being conveyed to the respiratory center from the focus of irritation by means of the vagus, and the efferent by the phrenics. Collapse of the lung may occur not only after injuries to the lung or thoracic wall, but, as well, after abdominal injuries quite remote from the diaphragmatic region. In civil practice, the majority of cases are direct sequelæ to abdominal operations, particularly those of the upper abdomen.

Briscoe believes the collapse to result from an exaggeration merely of the respiratory changes which take place when the supine position is adopted. In this position the costal type of diaphragmatic respiration is largely suspended, particularly in those patients whose respiration is mainly crural in origin. Subsequent irritation of the crura or of their pleural covering will lead to inhibition of the crural respiration and, hence, to paralysis and complete deflation. Whatever the actual mechanism which inhibits the diaphragm, the result is a cessation of ventilation of the lung, with speedy resorption of the residual alveolar air, and so complete collapse.

It is also of interest to note that in cases of pulmonary collapse from injury, the uninjured lung may frequently share in the condition. Two such cases occurred in the writer's experience.

Most commonly, massive collapse involves the whole of the lower lobe. More rarely the

whole of the lung may be involved, and very occasionally the upper lobe alone is affected. In cases where a part only of the lower lobe is collapsed a wedge-shaped area with the base downwards will be found. In civil practice, collapse following surgical operations most commonly affects one base only, but it may be bilateral, each side becoming involved successively or simultaneously.

In view of the fact that Briscoe has shown that the supine position favors collapse, the writer emphasizes the point that all patients who have undergone operations on the upper abdomen should be placed in the semi-upright position as soon as post-operative shock has passed off.

SOLOMON FINEMAN, M.D.

Massive Pulmonary Collapse. A. Bertram Soltau. *Brit. Med. Jour.*, March 21, 1925, p. 544.

Sciatica.—As a result of the clearly established fact that the true sciatic syndrome is the product of pathologic changes in the lumbar or pelvic articulations, the rationale of orthopedic measures becomes apparent. The poor results, then, that follow the injection method also become apparent, since they attack the consequences of the affection and not the origin. Although injections may be of service in certain selected cases, they have not had the success in our hands that foreign and some American enthusiasts have claimed for them. These facts have been corroborated in part by an important clinic and medical center in this country. We can, however, endorse without hesitation the stretching or manipulative treatment. In properly selected cases of true sciatica, due to static or traumatic sprains of the sacro-iliac joints, we possess a definite curative agency. The permanence of the cure depends on the proper after-treatment and the avoidance of faulty attitudes and additional trauma.

W. W. WASSON, M.D.

Sciatica: A Neuro-orthopedic Consideration. Charles Rosenheck and Harry Finkelstein. *Jour. Am. Med. Assn.*, March 28, 1925, p. 939.

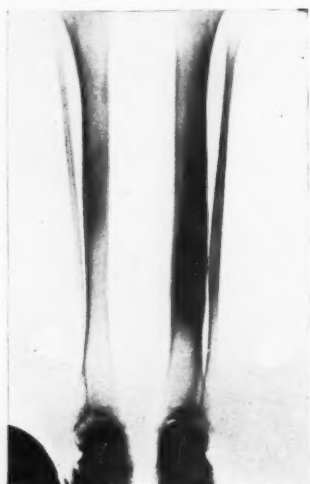
AN ANALYSIS OF BONE AND JOINT LESIONS OF KNOWN SYPHILITIC ORIGIN¹

By WILLIS C. CAMPBELL, M.D., MEMPHIS, TENN.

A CLEAR description of the evolution of any pathological process in bones and joints, as demonstrated by the X-ray, is often difficult to convey to others, and from the literature as found in many text books and articles on bone and joint syphilis, there is much confusion and unsatisfactory classification or standardization. Especially is this true of joint syphilis. Every known joint lesion, as hypertrophic and atrophic, arthritis, tuberculosis,

cent. In consequence, an analysis of a large number of known syphilitic bones and joints, from a radiological as well as a clinical point of view, might prove of interest on this occasion.

Syphilis of bones and joints is exceedingly rare in its second stage, presenting no characteristic signs or symptoms; consequently, will be dismissed with brief mention. Gross pathological changes in bones and joints are found only in the third or



Figs. 1 and 2 (left). Beginning periostitis left; periostitis and osteomyelitis right. (Right) Retroactive substitution of proliferative for destructive stage after intensive treatment.

osteocondritis juvenilis, exostosis, etc., has been attributed to lues. It has been stated that over 50 per cent of joints, routinely diagnosed and treated for tuberculosis, are, in reality, syphilitic and respond rapidly to antisiphilitic treatment. One writer dogmatically asserts that 10 per cent of all chronic joint affections are syphilitic; another, that there is no typical picture of joint syphilis. The Wassermann test is deemed unreliable in bone and joint syphilis and is said to be positive in only 50 per

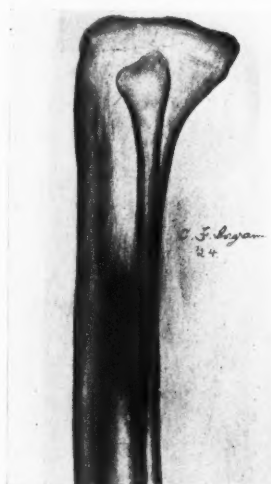


Fig. 3. Apparently central origin of the proliferative process.

tertiary stage. Trophic or parasymphilitis is a different and distinct problem and will be discussed only in a very general manner. The frequency and virulence of syphilis varies as to social conditions, local morality, and intelligence of the personnel from which the estimate is derived. Statistics have usually been compiled from clinics, with patients of the lowest stratum of life and poorest hygienic conditions. Those under consideration are obtained from the records of a private orthopedic clinic and orthopedic service in general and orthopedic hospitals. A very small number were

¹ Read before the Radiological Society of North America, December, 1924, at Kansas City.

Negroes. This is a fair average of private practice in America and far above that found in the charity institutions of large



Fig. 4. Congenital syphilis: proliferation of periosteum in strata.

cities. All were under personal supervision as to diagnosis as well as treatment.

A survey was made from private records, in which there were 130 with bone and joint syphilis. In addition, there were 13 parasyphilitic joints of the Charcot type and 33 in which syphilis existed coincident to, but independent of, other affections of bones and joints. Of the 130 with bone and joint syphilis, records of the blood Wassermann test were found in 100, of which 88 were distinctly positive and 12 negative. The percentage of positive reactions has been much higher during the past five or six years, since the Wassermann test has become better standardized and more efficient. This proves the diagnostic value is about the same as in syphilis in any other portion of the body. As the result of the blood Wassermann has been so satisfactory, the spinal fluid test has been rarely employed.

History of definite trauma was obtained in 35, but the records were not complete on this point; however, they were sufficiently complete to determine that trauma may



Fig. 5. Typical congenital syphilis in ulna of infant six weeks of age. Note periosteal proliferation and central sequestra.

induce typical luetic lesions in syphilitic subjects.

Of the 130 bone and joint syphilitic cases, 98 were acquired and 32 were congenital or hereditary. As there is much similarity, the entire group will be discussed, after which a comparative analysis will be made. The manifestations of bone syphilis, as demonstrated by the roentgenogram, are well known, and have been so clearly defined by the roentgenologist that any discussion before this Society might appear primitive, but there are, possibly, a few observations worthy of consideration and emphasis.

The pathological process is said to originate in the periosteum, but this in reality is probably doubtful and may be a reaction of central irritation, as has been suggested by the roentgenogram in several instances. Primary periostitis, from any cause, is exceedingly rare, and proliferation of the periosteum is usually the reaction of Nature to irritation in the bone or central canal, as is so clearly demonstrated in acute infectious osteomyelitis.

In all text books two types of syphilis of dense bone are described: first, periostitis; second, osteomyelitis. This is misleading, as they are different stages of the same

pathological condition and should be classed as proliferative and degenerative. The proliferative stage, or "periostitis," is the precursor of the degenerative type, or osteomyelitis. There may often be seen definite evidence of the evolution of such a

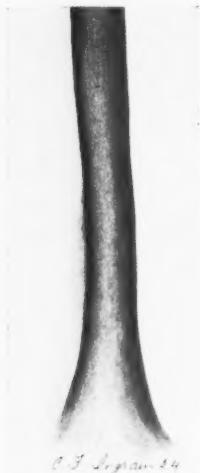


Fig. 6. Early proliferative changes as shown by fuzzy proliferation (right humerus).



Fig. 8. Proliferative stage in the tarso-metatarsal region.

process in different bones of the same individual, and when intensive treatment is ad-



Fig. 7. Typical proliferation of the middle third of right femur, only slightly suggestive of sarcoma. The periosteum is better organized than in sarcoma, with formation of bone trabeculae—so-called "lace work."

ministered the lesion becomes retro-active, the degenerative bone increasing in density and returning to the proliferative stage, or periostitis. In spongy bone the process is usually destructive from the onset.

Of the 80 cases with bone syphilis there were 51 in the proliferative period and 29 in the degenerative, the distribution being shown in the following tabulation:

PROLIFERATIVE OR PERIOSTEAL

Tibia	36
Femur	3
Rib	2
Skull	1
Foot	4
Humerus	3
Hand	1
Ulna	1



Fig. 9. Typical destructive process of spongy bone in the foot; increased opacity, with extrusion of bone through cortex. A late lesion approaching the trophic stage.



Fig. 10. Grotesque deformity, with crushing of spongy bone of both os calcii from normal weight.

DESTRUCTIVE OR OSTEOMYELITIC

Ulna	4
Tibia	6
Radius	4
Rib	1
Foot	6
Femur	1
Humerus	3
Skull	3
Clavicle	1

29

In about ten there were more than one focus. It is interesting to note the greater frequency of occurrence of the proliferative stage in the tibia as compared with the degenerative stage, which is probably due to early recognition and arrest of the process before degeneration developed.

The visualization of bone syphilis, as with roentgenoscopy in general, is a matter of instinct, which is acquired alone by experience. Various processes are often co-

existent, but the order of evolution is, in a general manner, as follows:

1. Distribution may be local in any part of a bone, diffuse throughout the entire bone, or multiple foci in two or more bones.

2. The first changes are more frequently apparent on the surface of the bone, as a fuzzy proliferation of the periosteum. Occasionally, the first evidence is a central opacity.

3. The periosteum may be arranged in strata with a definite space between.

4. "Bone blisters" may occur, with proliferation and elevation of the periosteum over a small area, co-existent with a destructive process which may break through the periosteum, forming an umbilicated cavity in the cortex,—a bone ulcer.

5. There may be a proliferation of the periosteum in the form of fine bone trabeculae anastomosing and forming the so-called "lace work."

6. The entire bone may be enlarged, with massive increase in size of cortex and gradual encroachment upon or obliteration

of the medulla. The process may be intensified on one surface, giving the appearance of bowing of the entire bone.

7. The degenerative stage, or "osteomyelitis," is manifested by a massive en-



Fig. 11. Typical destructive process; areas of increased opacity alternating with areas of degeneration, but no atrophy; pathologic fracture, which is observed only in this stage.

largement of bone, with areas of increased opacity alternating with areas of destruction, but not atrophy. The dense hypertrophied periosteum is gradually encroached upon and destroyed by the degenerative process. In spongy bone the destructive process is characterized by areas of increased opacity, obliteration of normal trabeculae and breaking through of the surface, forming nodular masses.

8. Opacity is characteristic of syphilis and probably indicates a spurious effort of Nature toward normal hypertrophy. Atrophic changes do not occur, as there is usually slight impairment of function. In other affections atrophy of adjunct parts results from disuse.

9. The occurrence is so frequent in the tibia that a roentgenogram of this bone should be made when bone and joint syphilis is suspected elsewhere, as hypertrophy of the cortex is strongly suggestive of syphilis. This is a point of diagnostic value.



Fig. 12. Syphilitic osteomyelitis complicated by acute infectious osteomyelitis, a secondary infection as a result of unnecessary operation through erroneous diagnosis. Anterior-posterior view showing cavity and osteoporosis.

The early changes of periosteal proliferation can be confused only with sclerosing osteomyelitis of Garré, in which condition the enlargement is usually spindle-shaped, in one portion of the bone, and the surface smoother and more regular than in syphilis. There is rarely an occasion to differentiate between syphilis and infectious osteomyelitis, except in the hands of a novice. The picture may be complicated when secondary infection has occurred, as a result of pernicious operative interference or spontaneous evacuation of pus with discharging sinus,—a true infectious osteomyelitis engrafted upon syphilitic osteitis.

Pathological fractures occur after extensive destruction and never in the early or proliferative stage, when probably the bone is even stronger than normal. Union in such fractures is not delayed, regardless of treatment.

Spurs of the os calcis, so-called gonorrheal exostosis, have also been attributed to syphilis, but are not a certain indication of

either condition. In this location syphilis produces a nodular mass; rarely, a sharp ridge appearing as a spur on side view.



Fig. 13. Syphilitic and acute infectious osteomyelitis; side view.

In syphilitic arthritis, as in all diseases of joints, there may be definite pathological changes in the soft structures, as the synovial membrane, ligaments, etc., before invasion of the bones is apparent, as evidenced by—



Fig. 14. Typical nodular proliferation of os calcis, which is quite different from the common spur or ridge often attributed to gonorrhea and syphilis, but not significant of either affection.

1. A chronic synovitis with increase of joint fluid and often distention of the capsule.

2. Hypertrophy of the capsule and intra-articular structures, so-called villous arthritis.

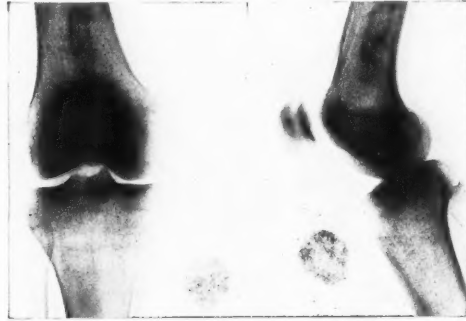


Fig. 15. Central proliferation with subjective symptoms referred to knee. Note oblong area of increased opacity and no proliferation of periosteum.

In bone syphilis there are usually gross changes prior to the subjective symptoms. In consequence, bone syphilis is early recognized and easily diagnosed, but in joint syphilis failure and confusion in diagnosing are common. It was with the possibility of throwing some light on this rather vague subject that this investigation was undertaken. There were 50 cases with joint syphilis, in which the distribution as to location was as follows:

JOINTS

Knee	22
Shoulder	3
Ankle	5
Elbow	3
Foot	5
Hip	6
Spine	3
Jaw	1
Hand	2

50

The most characteristic feature of joint syphilis is that the symptoms of pain, muscular spasm and disability are far less than the physical and roentgenological manifes-



Fig. 16. Small punched-out spot on lateral aspect of tibia, suggestive of syphilis.

tations would indicate. If this fact and the blood Wassermann be taken into consideration, the following changes, when demonstrated by the roentgenogram, are most suggestive, if not pathognomonic:

1. An increase in density of one of the bones of the articulation, often with gross hypertrophy, which is an extension of bone syphilis by continuity.



Fig. 17. Increased density, with area of proliferation on outer aspect of tibia. Extension of bone syphilis by direct continuity from below.

2. Proliferation of the periosteum on one of the bones forming the articulation, extra-articular and a short distance from the joint surface.

3. A definite punched-out area on the



Fig. 18. Syphilis of ankle, with punched-out areas on articular surface of tibia and astragalus.

- articular or extra-articular surface on the lateral or medial aspect.

4. A fuzziness of the joint surface, irregular opaque areas beneath the articular surfaces, with irregular, loose, highly refractal particles within the joint.

5. A large opaque area within the cancellous bone and a short distance from the articular surface.

6. Extensive destruction, but without atrophy of bone tissue, unless complicated by secondary infection.

Of the 50 cases, records of the Wassermann test were found in 37, of which 33 were positive and 4 negative; 26 with joint syphilis were acquired and 24 were congenital.

The clinical course of joint syphilis is indefinite, but the tendency is to spontaneous recovery. Bony ankylosis does not occur, though there may be deformity and impairment of function as an end-result.

Spinal syphilis has been suspected in a number of instances in which there were

definite bony changes, but not of sufficient individuality to warrant unqualified diagnosis. Apparently syphilis is infrequent in the spinal column; if not, we would surely more often be able to demonstrate charac-

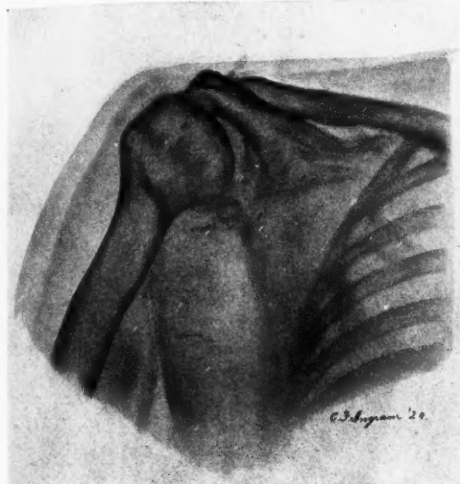


Fig. 19. Syphilis of shoulder, late tertiary stage, with areas of increased density and highly refractal bodies within the joint.

teristic syphilitic lesions. Syphilis in the spine, as in the joints, may be arrested by treatment before there is apparent invasion of the bone.

Differentiation has not been attempted between acquired and late congenital syph-



Fig. 20. Syphilitic polyarthritis, congenital, in boy aged seven; increased density in bone; punched-out areas; hypertrophy of capsule and soft structures, but no atrophy in bone.

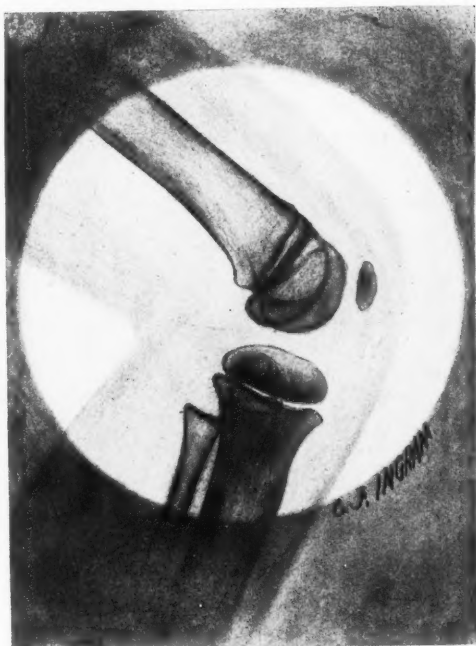


Fig. 21. Congenital syphilitic arthritis in boy aged five; distention of capsule; circumscribed destructive area in upper tibial epiphysis.

ilis. Only those cases below the age of puberty have been classed as congenital, of which there were 32. Bone syphilis was found in 8 and joint syphilis in 24. Of the bone, 6 were of the periosteal or proliferative stage and 2 in the destructive. Of the 24 joints, 4 showed a polyarthritis, while of acquired syphilitic arthritis there were only 2. Of 20 in which the Wassermann test was made, all were positive. Predilection for joints is particularly noticeable, a large percentage of joint syphilis being congenital.

Roentgenological manifestations in the epiphyses are well known, but cannot always be sharply distinguished from rickets. Syphilitic gumma are found in the epiphyses as small, well-defined cavities. Congenital syphilis is usually observed in young growing bone, but does not present sufficient structural variation from acquired syphilis in adults to warrant separate detailed description.

There were 13 trophic joints of the Charcot type,—6 knees, 4 hips, 2 ankles and 1 spine,—a fact which is mentioned only to emphasize the importance of early detection. Intensive treatment may occasionally



Fig. 22. Proliferative changes, with increased density, in luetic polyarthritis in girl aged six.

arrest the process, as occurred in the case of one knee.

In this survey there were 33 bone and joint lesions in which the clinical and roentgenological evidence did not suggest syphilis, but in all the Wassermann was strongly positive. The diagnoses follow:

NON-SYPHILITIC INFECTION WITH POSITIVE WASSERMANN

Infectious arthritis	8
Tuberculous hip	6
Tuberculous spine	2
Tuberculous knee	1
Myositis	2
Ununited fractures	4
Fractures	7
Infectious spondylitis	3

33

Of the 33, a few refused treatment, and a number were returned to their respective physicians. Seventeen received intensive



Fig. 23. Typical punched-out areas over head of femur; no change in acetabulum; clinically resembles coxa plana (Legg's disease).

treatment, under personal supervision, being given from six to twelve injections of salvarsan in conjunction with mercury and iodids; 9 cases were diagnosed tuberculosis, 2 atrophic arthritis, 3 hypertrophic arthritis and 4 ununited fractures. In not one case could the slightest beneficial effect on the pathological process be attributed to anti-syphilitic treatment. This tends to re-

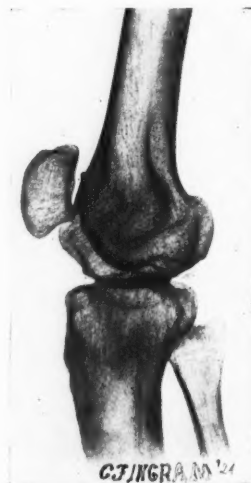


Fig. 24. Multiple punched-out areas over both femoral surfaces, an end-result of congenital syphilitic arthritis by spontaneous recovery without treatment.

fute the statement so frequently made that syphilis may assume all of the characteristics of every known joint disease. If syphilis of joints so closely resembles other affections, it does seem that one in this group might have been observed to respond to anti-syphilitic treatment. The fact that the Wassermann is positive or that there is a definite history of syphilis does not prove *per se* that any lesion in question is syphilis. It must be remembered that a host may harbor more than one disease at a time, as is so well demonstrated in this series.

The diagnosis of any pathological process cannot be and should not be made by

the roentgenogram alone. Bone tissue varies in reaction to the same reagent and may show similar changes from different etiological factors, but there are certain definite manifestations, above described, which, when taken into consideration with the Wassermann test and clinical and physical observation, are conclusive, and the diagnosis of joint syphilis, as well as of bone syphilis, can, in a very large percentage, be accurately made. Consequently, in the light of our present knowledge, to consider all chronic joint infections, suggestive of lues, is not alone untenable but unscientific.

Technic for lesions of female urethra.—The authors discuss urethral caruncle and primary carcinoma of the urethra, two lesions of the female urethra in which radium treatment seems to be the method of choice. Their present technic aims to cure the caruncle by one application of radium. The exact dose is difficult to estimate accurately as the same dose which produces considerable destruction of tissue in one patient will have but slight effect on the caruncle or normal tissue in another. Nitrous oxide anesthesia is used because of the exquisite local tenderness and to permit a thorough pelvic examination. A portion of the growth is excised for microscopic examination and the electro-cautery applied to the bleeding area left by the excision. Fifty mg. of radium element screened with 0.5 mm. silver, 1 mm. brass and 1 mm. rubber is applied to the urethral canal, and enough 5 mg. needles inserted to occupy the growth and surround the canal. A sponge is placed over the meatus and the labia united over this by a removable suture passed through the

outer end of the rubber covering the tube in the urethra. The radium is allowed to remain in position for from three to six hours, one treatment usually being sufficient. There is considerable local reaction following the treatment, but this soon subsides, and no recurrences have been experienced.

Treatment of urethral carcinomata is not satisfactory unless they can be diagnosed early. In certain of these early cases excision can be performed. In far advanced cases radium affords the best method of treatment of the local growth although palliation is all that can be hoped for in many cases. The regional lymphatics should be treated by roentgen radiation or by excision, unless the primary growth is so far advanced as to make the possibility of a cure very remote.

J. D. CAMP, M.D.

Radium in Lesions of the Female Urethra.
L. A. Pomeroy and F. W. Milward. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 524.

MULTIPLE MYELOMA¹

By HENRY W. MEYERDING, M.D., Section on Orthopedic Surgery, Mayo Clinic, ROCHESTER, MINNESOTA

TO the roentgenologist, multiple myeloma presents a most interesting problem. He must bear in mind this rare condition in his interpretation of apparent single tumors, injury and disease of the spine, suspected carcinoma, metastasis, and those more vague complaints, such as backache, in which he is called on in the hope of clearing up the diagnosis. Not infrequently the roentgenogram gives the first information as to the true nature of the complaint and no doubt it is largely responsible for the increased number of case reports found in the literature. Especially important is the ability of the roentgenologist to determine the local or general character of the neoplasm. The finer differentiations of carcinoma, metastasis, endothelioma, chloroma, generalized fibrocystic disease, chondroma, and so forth, and multiple myeloma may baffle the most expert, and at times be impossible. To assume the responsibility of making a positive diagnosis and prognosis in tumors of the osseous system, from X-ray findings alone, is often the cause of embarrassment. I have previously called attention to the value of a careful history, clinical findings, and laboratory studies in the diagnosis of bone tumors, as well as to the necessity of exploratory operations and microscopic examinations of tissue (5). Although the roentgenogram may not always indicate a definite diagnosis, yet it permits the origin, site, size, osteoclastic or osteoblastic character, localization in, or invasion through, osseous and periosteal structures to be studied. Further, pulmonary metastasis is demonstrable in the roentgenogram before clinical signs appear. The skillful roentgenologist who can interpret plates wisely, is indispensable in the early diagnosis of bone tumors, and his co-operation with the clinician and surgeon should lead to greater accuracy of diagnosis and prognosis and to better results in treatment. I have dis-

cussed elsewhere the roentgenographic findings of cystic and fibrocystic disease, chondromas, giant-cell tumors, and sarcomas (7, 8). The surgeon must depend on the roentgenogram in differentiating the local or general character of the growth, and for early evidence of pulmonary metastasis; the clinical evidence is often indeterminate, and the apparently local lesion may subsequently prove to be a generalized neoplasm.

In 1845, Bence-Jones described a protein found in a case which had been diagnosed osteomalacia; necropsy disclosed softening and decalcification of the sternum and ribs. This protein was precipitated on the addition of nitric acid to the urine, disappeared when heated, and reappeared on cooling. It has since been found that it appears in 80 per cent of cases of multiple myeloma. In 1889, Kähler described a similar case, and suggested that the protein might be diagnostic of multiple myeloma; as a result the condition has been referred to as "Kähler's disease." Ewing accredits McIntyre with the first description of the entity in 1850, under the term "mollitus osium" (osteomalacia). Further investigation has shown that the protein may occur in leukemia, nephritis, hypertension, and carcinomatosis. Walters reported three cases of Bence-Jones proteinuria from the Mayo Clinic, one in a patient with general carcinomatosis, one with multiple myeloma, and one in whom the diagnosis was obscure. Case reports have increased with the more common use of the X-ray in recent years: Martiri collected 204 cases of Kähler's disease in 1916, and Wallgren 105, in which histologic diagnosis was made, also adding thirteen of his own. In 6,000 necropsies at Bellevue Hospital, New York, Symmers found three cases of multiple myeloma.

The clinical history is often of little value, especially in the early stages, rheumatic, neuritic, or what appear to be neu-

¹Read before the Radiological Society of North America, at Kansas City, Missouri, December 8 to 12, 1924.

rotic pains, with or without fever, being all that are elicited. Later the weakness, loss of weight, and anemia suggest malignancy. There may be spinal deformity, referred pain, and a history of fracture. Histories of injury followed by tumor formation (Case 2), of heavy lifting followed by pain, of lumbago, backache, pains in the chest, or rheumatism are not uncommon. The presence of large quantities of albumin in otherwise normal urine should suggest multiple myeloma, and the urine should be examined for the Bence-Jones protein. Tumors may have been noted which apparently receded, or the patient may recall tenderness of bone during a previous illness, stiffness of the spine, with pain on coughing, sneezing, and so forth. Periods of relief from symptoms, that is, intermittency of symptoms, may occur. Symptoms vary greatly, and although the pain is usually of a mild rheumatic character, it may assume the severe, boring type, be aggravated by motion, and be more severe at night. There may be periods of recession of symptoms, and possibly of entire absence, as shown in a case reported by Osgood. Symptoms also vary according to the location, size, and number of tumors present, as in the chest wall, spine, skull, and so forth. Careful examination of the spine in all cases of unexplained abdominal complaints is essential, as multiple myeloma and other lesions involving the spinal column may be the cause. Bone deformities develop, and fractures may occur. Soft, tender masses in the sternum, ribs and clavicles are not uncommonly palpable, and these tumors may vary in size, apparently recede, or pulsate. With further involvement, progressive anemia and exhaustion take place, with loss of weight; at this stage tumor formation or paraplegia may be noted. The age is of some importance, 60 per cent of the cases of multiple myeloma occurring between forty and sixty years (3). Berkheiser has reported two cases in children, one at three and one-half, and one at twelve and one-half years of age. In the thirteen cases here reported, the youngest patient

was forty-three years, and the oldest sixty-nine years. There were nine men, and four women.

It is evident, therefore, that the clinical history may or may not be of value. However, the history of pain occurring at irregular intervals, bone tenderness, general weakness, secondary anemia, and the presence of albumin in the urine should be suggestive, especially if the urine is otherwise normal, and no primary malignancy is found. The X-ray examination of the spine, thorax, and skull in suspected cases may show multiple areas of destruction in the bone marrow. Many of these tumors appear to be punched out, and are especially clear-cut in the skull, having a well-defined margin; the tumor itself being of osteoclastic nature casts little or no shadow (Case 3). Hundreds of these tumors may be seen in the roentgenogram of the skull (Case 2); in others, only a few may be noted. Thus a fairly early case with fracture may be mistaken roentgenologically for cystic disease, although the age would contra-indicate such a lesion. A distinctive feature of these tumors from a roentgenographic standpoint is that they are usually multiple, and occur simultaneously in the bone marrow, especially in the spine, sternum, ribs, skull and clavicles. The tumors may enlarge and erode the cortex until only a thin shell remains, which crepitates on firm pressure, and is somewhat tender. Later they may perforate into the periosteal structures, giving a punched-out appearance, or a honeycomb appearance to the bone, due to the shadow cast from remaining particles of bone on the surface of the tumor. If the involvement is extensive, there may be only a slight shadow, and differentiation is impossible. Spinal stiffness and kyphosis, with tenderness in the bones and pains in the chest or abdomen, in elderly patients, warrant X-ray studies and a careful examination of the urine. Strain, such as in heavy lifting, may result in crushing of the involved vertebrae, and even paraplegia may result, simulating tuberculosis. The vertebrae, ribs,

sternum, clavicles, skull, scapula, and pelvis are most commonly involved, although the bones of the extremities may also be affected. On section, the growth appears red or grayish red. With softening and crushing, fracture occurs, and sometimes hemorrhagic areas. As these multiple tumors enlarge, absorption of bone structures takes place, and weakening and fracture, or crushing of the vertebræ results. The tumor may be so extensive as to make differentiation difficult or impossible, the whole bony structure being replaced by tumor tissue, thus producing indefinite shadows in the roentgenogram. The etiology is unknown; trauma and infection have been considered. Of the eleven cases herein reported, there was trauma in six, trauma and infection in one, and infection only in four. Apparently Bence-Jones protein may occur in other tissues of the body. Rosenbloom has reviewed the history of Bence-Jones protein and multiple myeloma, and gives a bibliography of several hundred articles on the subject.

DIFFERENTIAL DIAGNOSIS

Metastasis from carcinoma is not primary in bone, and the history, symptoms, and clinical findings usually give a clue to the original growth. The areas of metastasis are usually near the middle of the bone, at the entrance of the blood supply. Pain is more likely to be severe, especially in metastasis to the spinal column, which is more rapidly fatal. Bence-Jones proteinuria is very rare in cases of carcinoma. X-ray examination reveals rapid growth, invasion, destruction of the cortex, and the shadows are less definite than in multiple myeloma. Metastasis from carcinoma of the breast occurs in similar areas to that of multiple myeloma, and may be impossible to differentiate. Metastasis from the prostate, however, occurs slowly, and usually the calcium salts deposited in Nature's attempt to capsule the tumors appear roentgenographically as a condensation of the entire bone, so that its structure seems to

be uniform and sclerotic. The pelvic bones, sacrum, lower lumbar spine, and femur are most commonly affected; these bones are rarely involved in myeloma.

Multiple endothelioma may simulate multiple myeloma, and in the absence of Bence-Jones protein in the urine, it would be practically impossible to make a diagnosis by means of the roentgenogram.

Metastasis from hypernephroma usually occurs in the upper part of the body, and the history, clinical and laboratory findings, will aid in differentiation.

Sarcoma is more common in early middle life. The osteogenetic type may be disregarded, as it is bone-producing and easily differentiated. The medullary osteoclastic variety grows more rapidly, and occurs in the ends of bones, seldom in the ribs and skull simultaneously. It produces metastasis to the lungs, and is rapidly fatal (9).

Osteomalacia usually occurs in women following pregnancy. It does not show the typical involvement of the skull, and is characterized by diffuse absorption of lime salts, softening and deformity.

Chloroma is distributed similarly to multiple myeloma, that is, chiefly in the skull, but also in the vertebræ and ribs, and in certain other bones it is associated with a leukemia. It occurs usually in the young, and, like multiple myeloma, is more common in males. The clinical and laboratory findings must be resorted to in differentiation. The typical greenish color of these tumors is one of their gross characteristics.

Generalized forms of fibrocystic disease produce striations, trabeculations, and multilocular cystic areas involving the medullary cancellous bone and cortex, usually without involvement of the periosteum or epiphyses. They may cause the production of bone, but never invasion, and occur earlier in life than myeloma.

Giant-cell tumors show fairly sharp outlines, and usually involve the epiphyses at the ends of the long bones. The cortex may be absorbed, but it rarely perforates the periosteum, and although it penetrates, it never invades the periosseous structures.

The distribution of multiple myeloma in the thorax and skull in the cancellous bone would ordinarily make differentiation easy, as giant-cell tumors are very rarely other than local growths, and usually occur earlier in life.

Chondromas usually occur in areas normally associated with cartilage, although the multiple type might be confused with multiple myeloma. They are firmer on palpation, are not tender, and are more common in the extremities at the ends of long bones (6).

The possibility of mistaking tuberculosis of the spine for multiple myeloma has been brought out by Osgood.

TREATMENT

Recumbency or fixation in plaster-of-Paris alleviates the pain to a great extent, when spinal involvement gives rise to symptoms of referred pain. Radiotherapy should be given a trial, and the results carefully recorded so that the profession may have an opportunity to determine the therapeutic value in this rare condition. In surgery we find a means of establishing a diagnosis, and differentiating this condition from other multiple lesions involving the osseous system. Exploration and microscopic study of tissue are especially valuable when the clinical findings, history, and the laboratory and X-ray data are indeterminate. Transfusion has been resorted to, but is of transient value.

The prognosis is unfavorable. The average length of life in the thirteen cases was approximately twenty-two months from the onset of symptoms. The shortest duration was three months, and the longest, four years and two months.

REPORT OF THIRTEEN CASES

Case 1 (Figs. 1 and 2).—A woman, fifty-one years of age, came to the Clinic November 12, 1917. The right humerus had fractured following slight trauma two weeks before. The diagnosis was bone cyst

with pathologic fracture of the right humerus. Urinalysis was negative; no Bence-Jones test was made. The hemoglobin was 75 per cent, and the leukocytes numbered 9,400. As the arm had been properly

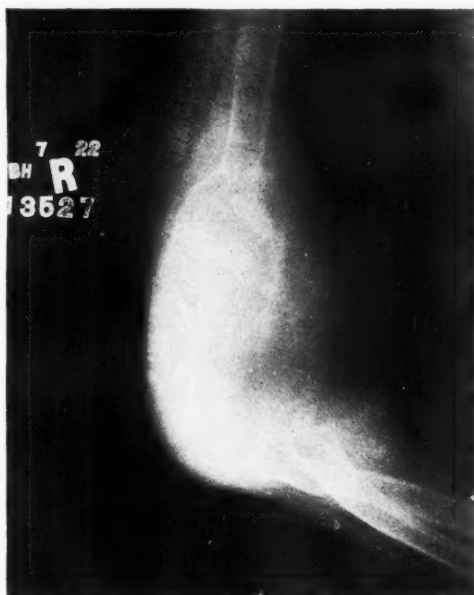


Fig. 1 (Case 1).—Multiple myeloma of the right humerus, after five years' growth and two fractures.

splinted by the home physician, the patient was allowed to return home without further treatment.

In May, 1918, the patient fell and re-fractured the arm, but apparently made a good recovery until March, 1919, when severe pain and soreness developed. The urine was acid, with a trace of albumin; the specific gravity was 1.018. A diagnosis of giant-cell tumor was made; operation was not advised.

January 7, 1922, the patient returned for observation because of marked increase in the size of the tumor following a third injury. Considerable pain and increasing weakness were present; the superficial veins were enlarged. The patient had lost 30 pounds since 1917. Urinalysis now revealed Bence-Jones protein. There were multiple palpable tumors in the bones of

the skull. Roentgenograms revealed multiple cystic areas in the skull, a large tumor of the lower half of the right humerus, and two questionable tumors of the left humerus. Roentgenograms of the chest were

her 29, 1923, complaining of weakness, drowsiness and loss of weight. He had had typhoid fever in 1900, and had been subject to attacks of tonsillitis. A year before coming to the Clinic, he had injured his

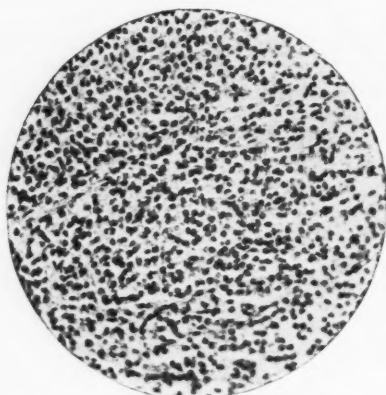


Fig. 2 (Case 1).—Photomicrograph of specimen

apparently negative, as also were those of the spine and femur. The hemoglobin was now 46 per cent; the erythrocytes numbered 2,680,000, and the leukocytes 6,700. The differential count was lymphocytes 20 per cent, large mononuclears 5.5, transitionals 7.5, neutrophils 60.5, and eosinophils 6.5; the Wassermann reaction was negative. January 14, the tumor of the right humerus was explored. A specimen was removed; the material was a reddish gray, and bled freely. The pathologist's diagnosis was myeloma. Radiotherapy was given and the patient advised to continue treatment at home. She died March 17, 1922, four years and two months after the first fracture.

Comment.—The course of the disease would probably have been unaltered by treatment, yet exploration and microscopic examination would have revealed the true nature of the neoplasm five years earlier. Multiple myeloma is not infrequently the cause of fracture, and may be confused in its early stages with fibrocystic diseases, osteitis fibrosa cystica, and giant-cell tumors.

Case 2 (Fig. 3).—A carpenter, forty-three years of age, came to the Clinic Octo-



Fig. 3 (Case 2).—Multiple myeloma of the skull

ber 29, 1923, complaining of weakness, drowsiness and loss of weight. He had had typhoid fever in 1900, and had been subject to attacks of tonsillitis. A year before coming to the Clinic, he had injured his head. He was admitted to the hospital as an emergency patient. His memory was vague and the history was obtained with difficulty. About a year before, he had struck his head on a beam in the right posterior parietal region, and believed he had been unconscious for a few moments. After the injury he thought he could feel a dent in the skull. Later a swelling occurred in the same area. For the past six months, his general condition had been growing rapidly worse, as evidenced by restlessness, insomnia, weakness, frequent stumbling, and mental sluggishness. He had pain in the elbows, a moderate cough, and incontinence of urine when the bladder was distended.

The patient was pale and somnolent, and recounted his history with much hesitation, contradiction, and uncertainty; articulation was somewhat thick. The mucous membranes appeared anemic, and there was a circular, soft area, 5 cm. in diameter and 0.6 cm. in elevation, over the right parietal area. The rim of this skull defect could be plainly felt. The patient occasionally expectorated blood-tinged phlegm, apparently from the nasopharynx. The pulse rate was 84, systolic blood pressure 126,

and diastolic 44. An area of cardiac dullness extended from the right sternal border to the left axillary line. There was a forcible apex impulse in the fifth interspace, 2.5 cm. within the axillary line, and a loud

basophils 0.5. November 6, the hemoglobin was 28 per cent; the erythrocytes numbered 1,600,000, and leukocytes 4,200. The blood Wassermann was negative, and the blood culture was also negative. It was the

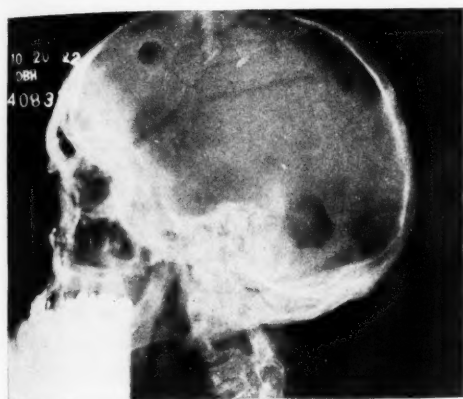


Fig. 4 (Case 3).—Multiple myeloma of the skull. Note the large areas of involvement as compared with Case 2.

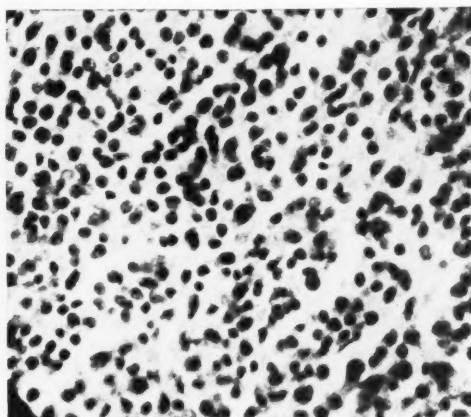


Fig. 5 (Case 3).—Photomicrograph of specimen

systolic murmur transmitted to the left, loudest over the apex. The liver was palpable and slightly tender. The arms were painful on movement, especially at the left elbow. The strength of the arms was greatly reduced, and all tendon reflexes were exaggerated. The blood urea was 62, creatinin 3.8, uric acid 5.2, carbon dioxide 52 volumes per cent, sugar 0.132. Urinalysis revealed no sugar and no diacetic acid. Roentgenograms of the osseous system revealed multiple areas of bone destruction in the humeri, upper end of the left radius and ulna, left tibia and ribs. Urinalysis, October 30, 1923, of a twenty-four-hour specimen of 1,600 c.c. showed an acid reaction, specific gravity 1.013, albumin 3, and Bence-Jones protein. For five consecutive days the amounts of Bence-Jones protein were 21.3, 28, 28, 27.8, and 26.6 gm. Examination of the blood, October 31, revealed a hemoglobin of 35 per cent; the erythrocytes numbered 2,130,000, and the leukocytes 7,800. The differential count, November 2, was lymphocytes 34.5 per cent, large mononuclears 4.5, transitionals 3.0, neutrophils 56.0, eosinophils 1.5, and

opinion of the neurologists that there was intracranial pressure due to multiple bone lesions. The patient was in a critical condition at the time of examination. His death was reported in June, 1924, twenty months after injury.

Comment.—The patient had been diagnosed a diabetic. He had the neuritic pains in the elbows commonly complained of in myeloma. There is a good history of trauma and infection. The first tumor arose at the site of injury. The X-ray findings, with Bence-Jones protein and the subsequent history, warrant the diagnosis of multiple myeloma.

Case 3 (Figs. 4 and 5).—A man, fifty-five years of age, came to the Clinic October 20, 1922, complaining of double vision. One sister had died of tuberculosis; otherwise, the family history was negative. The patient had always been well except for an attack of malaria eight years before coming to the Clinic. Four months before, he had noticed on the top of his head a small tumor which gradually increased in size. Two months before, an infected tooth had been removed because of neurotic pains. Two weeks before, double vision had been noted,

and pains, which were thought to be due to neuritis, had developed in the arms and chest.

The patient's height and weight were normal. The systolic blood pressure was 120, and the diastolic 80; the pulse rate was 90. Vision was 6/30 in each eye, with correction 6/5; the right pupil was larger than the left; the reflexes, fields, and fundi were negative. The tumor was soft on palpation, and an area of bone in the posterior parietal region on the left side was apparently destroyed. The roentgenogram revealed several areas of destruction in the skull. There were also areas of destruction in the left clavicle, second right rib, and the first left rib. No definite involvement was evident in the spine or pelvis. Examination of the lungs was negative. Urinalysis, October 21, 1922, of a twelve-hour specimen of 500 c.c. showed acid reaction, specific gravity 1.027, and a trace of albumin. October 23, examination was made of a twelve-hour specimen of 300 c.c. which revealed an acid reaction, specific gravity 1.034, albumin, and occasional hyaline casts; the Bence-Jones test was negative. Examination of the blood revealed a hemoglobin of 75 per cent; the blood Wassermann reaction was negative. A diagnosis of multiple myeloma was made. The patient died May 17, 1923, ten months after the tumor of the skull was found. Necropsy revealed multiple myeloma involving the base of the skull, calvarium, ribs, and right clavicle, emaciation, hypostatic edema, congestion of the lungs, arteriosclerosis, dilated bladder, old healed tuberculosis, pleuritis, and lymphadenitis.

Comment.—The absence of Bence-Jones protein occurs in 20 per cent of cases of multiple myeloma.

Case 4.—A minister, forty-nine years of age, came to the Clinic April 9, 1914, because of a tumor of the left clavicle. Six months before he had slipped and fallen. Severe pain in the region of the left clavicle resulted, which was diagnosed as due to fracture. The pain continued, and a tumor developed two months after the original in-

jury. Two weeks before coming to the Clinic, the patient had been in a railroad wreck. The physician who examined him diagnosed the condition as sarcoma, and advised operation. The pains were localized in the back of the right thigh; some relief was afforded by the recumbent position.

Examination revealed a hard, firm, smooth tumor of the left clavicle. There was some atrophy in the left arm and shoulder. Urinalysis revealed an acid reaction, specific gravity 1.016, a trace of albumin, an occasional cast, and leukocytes. The roentgenologist's diagnosis was sarcoma of the sternal end of the left clavicle. Operation was performed April 16, the inner half of the left clavicle being removed. The bone was found to be very soft, and the tumor had apparently broken through into the soft tissue, and was adherent to the pleura. The patient returned five months later with involvement of the right clavicle; the inner two-thirds of the right clavicle was removed. Pathologic examination revealed myeloma. The patient died in January, 1915, fifteen months after injury.

Case 5.—A coal miner, sixty-nine years of age, came to the Clinic November 15, 1920. He had been well until two years before, when stiffness of the neck and back had developed following exposure. Four months later, a nodule was discovered on the left thoracic wall, attached to the fifth and sixth ribs; it began to increase in size and became quite painful. The patient complained of extreme pain in the right half of the thorax, and of a troublesome, loose, productive cough.

Repeated examinations of the lungs were negative. The tumor was attached to the fifth and sixth ribs, and in the left anterior axillary line measured 10 by 7.5 cm. The lower portion of both sides of the thorax bulged; the dorsal vertebræ were fixed. There was a marked tenderness to pressure on the second, third, fourth, fifth, and sixth ribs of the right side in the parasternal and anterior axillary lines. The skull and the long bones were not tender to pressure.

Urinalysis revealed the presence of Bence-Jones protein. Examination of the blood November 24, 1920, showed a hemoglobin of 50 per cent; the erythrocytes numbered 2,780,000, and leukocytes 6,200. The differential count was polymorphonuclears 80.2 per cent, small lymphocytes 13.8, large lymphocytes 3.4, eosinophils 0.4, transitionals 2.2, slight anisocytosis and poikilocytosis. A roentgenogram of the bones revealed multiple circumscribed areas of destruction in the skull, the femurs, tibiae and radii, varying in size from 0.2 to 0.5 cm., and a fracture of the fifth, sixth, seventh, and eighth ribs of the right side. A specimen removed from the tumor on the left side of the chest wall was reported to be round-cell sarcoma or myeloma. The patient died in May, 1921, about two and one-half years after the onset of symptoms.

Case 6.—A merchant, forty-eight years of age, came to the Clinic September 20, 1922, complaining of pain in the back, chest, and sides. He had had an inguinal hernia for the last fifteen years. A year before coming to the Clinic he had lifted a trunk and subsequently had noticed a backache and pain in the left thigh. He had received treatment for rheumatism, but in the last two months the symptoms were aggravated, especially the pain in the chest. He said he had been failing in health and had been unable to be up and about for the last seven weeks. The patient was examined with difficulty as there was considerable pain on slight motion.

Examination revealed the systolic blood pressure to be 120, and diastolic 97. There was a painful prominence in the mid-dorsal area, and a right inguinal hernia. Roentgenograms revealed destruction of the seventh, eighth, and ninth ribs near the spine; there was also destruction of the vertebrae in the dorsal lumbar region. Roentgenograms of the chest were negative. Urinalysis, September 20, 1922, showed specific gravity 1.021, albumin 2, a few granular and hyaline casts, and also a few leukocytes. The Bence-Jones test was positive. Examination of the blood revealed a hemo-

globin of 69 per cent; the erythrocytes numbered 4,120,000, and the leukocytes 12,700; the blood Wassermann reaction was negative.

The patient returned home and his physician wrote that there was a gradual decline with rarefaction of the vertebrae and fracture of the ribs. The Bence-Jones protein was again found. Loss of power in the left leg developed; the patient died December 11, 1922, fifteen months after the onset of symptoms. Necropsy was not performed.

Comment.—A history of strain and persistent backache associated later with chest pains and weakness led to the diagnosis of multiple myeloma. These symptoms would have caused suspicion of tuberculosis of the spine if they had not been readily differentiated by the destruction in the ribs, as shown in the roentgenogram and by the presence of Bence-Jones protein.

Case 7.—In a case reported by Walters in 1921, Bence-Jones protein was found in large quantities. Roentgenograms of the spine revealed hypertrophic arthritis. Marked secondary anemia was present; laparotomy revealed no lesions. The case no doubt was one of multiple myeloma which failed to show definite osseous involvement. The blood pressure, blood urea, and kidney function were normal. An interesting finding in this patient was the Bence-Jones protein crystals, which precipitated spontaneously at room temperature.

Case 8.—A farmer, fifty-seven years of age, came to the Clinic September 13, 1922, because of multiple bone tumors and an ununited fracture of the right femur, with swelling. His grandfather had had a tumor of the neck, and an aunt had had a bone disease and a fractured leg. At the age of seventeen, the patient had had rheumatism, and at twenty-three influenza. In February, 1922, he had had pain in the chest for three weeks, and rheumatic pains in the left hip and legs. At this time, his legs felt weak, and as if they would break. In April, a tumor appeared on the left side of the head, and about a month later, an-

other over the back of the skull. In June, the fifth month of illness, the patient had had a slight fall, and sustained fractures of both femurs. He was taken to a hospital where the left femur united under treatment, but the right did not; a tumor formed at the site of the non-union. Tumors of the right humerus and chest were also noticed.

The patient was unable to walk, and had lost 42 pounds. The systolic blood pressure was 150, and the diastolic 80. There were several infected teeth. Urinalysis, September 13, revealed a specific gravity of 1.018, alkaline reaction, and a trace of albumin. September 14, there was acid reaction, a specific gravity of 1.022, albumin 1, no Bence-Jones protein, a few hyaline and granular casts, and an occasional leukocyte. September 20, there was acid reaction, a specific gravity of 1.017, albumin 1, no Bence-Jones protein, and occasional erythrocytes and leukocytes. Examination of the blood, September 14, revealed a hemoglobin of 54 per cent; the erythrocytes numbered 4,000,000, and the leukocytes 12,500. The differential count was lymphocytes 24 per cent, large mononuclears 2, transitionals 1.0, neutrophils 69.5, eosinophils 3.0, and basophils 0.5. September 16, there was a hemoglobin of 60 per cent; the erythrocytes numbered 3,960,000, and the leukocytes 8,200. The blood Wassermann reaction was negative. Roentgenograms revealed a tumor, malunion of the upper third of the right femur, and an ununited fracture of the upper third of the left femur. There were areas of decreased density in the frontoparietal area, both humeri, and pelvis; the ribs were indeterminate. The diagnosis was multiple myeloma with non-union of the left femur. The patient died November 11, 1922, nine months after the onset of symptoms.

Comment.—The patient had rheumatic pains in the legs and chest. A slight fall caused fractures of both femora. Although the legs were treated at the same time and in the same manner, non-union resulted in the left femur. Although the Bence-Jones

protein was absent, a diagnosis of multiple myeloma was made on the basis of the X-ray findings, and was verified at death.

Case 9.—A married woman, aged fifty-two years, came to the Clinic November 15, 1923, with a variety of complaints, and a report from the home physician that considerable albumin was present in the urine. Two years before, the patient had been injured by falling and striking her right hip and back on a stone floor. She stated that she had been completely paralyzed, although sphincter control was normal. Paralysis persisted for a period of three weeks, and then the patient had a nervous collapse. Ability to move the lower limbs returned gradually, followed by moderate general improvement, and within four months the patient was able to get about fairly well. Stiffness persisted in the back. When the patient came to the Clinic, she complained of weakness and fatigue following the slightest exertion. After meals she had a feeling of fullness and bloating in the epigastrium, accompanied by dull pain and continual soreness. Constipation was marked. There was a persistent soreness in the right lower quadrant, and transitory pains in her hips and shoulders, which sometimes became sufficiently severe to incapacitate her. Small nodular swellings occurred intermittently along the margins of the ribs, lasted from one-half to three days at a time, and were extremely tender. They did not appear to be attached to the ribs.

The patient was a thin, anemic woman, weighing 95 pounds. Her blood pressure, pulse rate, and temperature were normal. The heart was of normal size, but a systolic bruit was audible over the mitral area. The spine was moderately immobile with some dorsal kyphosis. There was generalized abdominal tenderness, and a small fibroid in the uterus. Hemoglobin was 61 per cent; the erythrocytes numbered 3,410,000, and the leukocytes ranged from 4,900 to 9,600. There were occasional pus cells in the urine, and a large amount of albumin, which was found to be almost entirely

the Bence-Jones protein. An intravenous phenolsulphonaphthalein test showed a return of 30 per cent after two hours. Urea was 66 mg., and creatinin 2.5 mg. for each 100 c.c. of blood. Roentgenograms revealed destruction of the dorsal vertebræ, ribs, and bones of the shoulder joint, as well as multiple areas of destruction in the skull. A diagnosis of multiple myeloma was made. In July, 1924, the patient was reported as improved, and able to be up and about in a wheel-chair six hours daily.

Comment.—There is a history of trauma and of apparent paralysis, abdominal bloating, pain and distress, constipation, intermittent attacks of pain of varying intensity, and tender, intermittent swellings along the ribs. The large quantity of albumin in otherwise negative urine, intermittent pains, tumors over the thorax, secondary anemia, and moderate kyphos of the spine were strongly indicative of multiple myeloma, and in the presence of Bence-Jones protein warranted the diagnosis.

Case 10.—A farmer, forty-seven years of age, came to the Clinic October 27, 1922, complaining of backache. He had had no previous illness other than rheumatic pains in the hip. Fourteen months before coming to the Clinic, he had had "lumbago," brought on by heavy lifting. A lumbar backache developed which was aggravated by strain. About two months before, the patient had noticed pain around the lower ribs, which steadily became worse. Jolting and jarring aggravated it; rest relieved it. His energy and appetite were below normal.

The patient's height was 5 ft. 8 in., and his weight, 150 pounds, which was 10 pounds below normal. The tonsils were infected and five teeth showed periapical infection. The pulse and temperature were normal. Roentgenograms revealed destruction of the eighth rib on the right, near the spine, with small areas of destruction in the ribs on the left, probably multiple myeloma; there were also hypertrophic changes in the lumbar spine. A dorsal, rounded kyphos was present. Urinalysis of a twelve-hour specimen of 1,158 c.c. showed an acid

reaction, specific gravity 1.018, albumin 3, and the Bence-Jones protein test was positive. Examination of the blood revealed a hemoglobin of 72 per cent, and a leukocyte count of 9,100. A combined phenolsulphonaphthalein test showed a return of 45 per cent in two hours.

Biopsy and radiotherapy were advised. The patient returned home and died January 14, 1923, seventeen months after the onset of symptoms. Death was ascribed to acute nephritis complicating multiple myeloma. Necropsy was not performed.

Comment.—The history of crushing of vertebræ, while doing heavy lifting or following injury, has been noted in cases previously reported in the literature. The diagnosis of tuberculosis has been made, and even operation performed in such cases. Therefore, the radiologist must always be on guard for multiple myeloma.

Case 11.—A married woman, sixty-one years of age, came to the Clinic January 22, 1923, complaining of constipation and distress in the upper right abdomen. Her mother had died of carcinoma of the breast. For the last nine years the patient had had attacks of diarrhea, and occasional attacks of tonsillitis. Her present complaint had begun a month before she came to the Clinic, and was characterized by severe constipation, epigastric distress, especially on the right side, and rheumatic pains in the knees. Some swelling was noticed about the right knee. There was no nausea or vomiting.

The patient's weight was 185 pounds, and her height 5 ft. 4.5 in. There had been a loss of 21 pounds in six months. The systolic blood pressure was 160, diastolic 70, pulse rate 78, and temperature 99.2°; the tonsils were infected. Roentgenograms revealed hypertrophic arthritis of the right knee, with loose bodies, hypertrophic arthritis of the spine, rarefied areas in both femora and in the skull, and multiple circular areas of lessened density. Shadows in the colon suggested diverticula. Urinalysis, January 24, 1923, of a twelve-hour specimen of 700 c.c. showed an acid reaction,

specific gravity 1.012, albumin 4, and Bence-Jones protein 4. There were occasional leukocytes and erythrocytes. Urinalysis, January 25, of a specimen of 950 c.c. revealed an acid reaction, Bence-Jones

to the suspicion of malignancy. Because of the bone tenderness, roentgenograms were taken which revealed multiple areas of bone destruction suspected of being metastatic. The rheumatic or neurotic pains



Fig. 6 (Case 13).—Multiple myeloma of the bones of the forearm, wrist, and hand.

protein, a few hyaline casts, and a few blood cells. Examination of the blood revealed a hemoglobin of 73 per cent, erythrocytes numbering 4,000,000, and leukocytes 8,800. January 26, examination showed a hemoglobin of 70 per cent, erythrocytes numbering 3,670,000, and leukocytes 9,100; lymphocytes 22 per cent, large mononuclears 2.5, transitionals 2.5, neutrophils 72.5, eosinophils 0.5, and basophils 0.5. The Wassermann reaction was negative. The patient died February 10, 1923, three months after the onset of symptoms. The home physician ascribed the immediate death to cerebral hemorrhage. The diagnosis was multiple myeloma.

Comment.—This case illustrates the vagueness of symptoms pointing to multiple myeloma: constipation, epigastric distress, and rheumatic pains in the legs. The loss of weight and the abdominal complaint led



Fig. 7 (Case 13).—Multiple myeloma of the skull

in the legs are common. The finding of Bence-Jones protein in the urine, however, in the absence of a primary malignant tumor, would warrant the diagnosis of multiple myeloma.

Case 12.—A farmer, fifty-six years of age, came to the Clinic August 3, 1923, complaining of pain in the chest of four months' duration, following injuries received in a fall from a wagon. The pain was aggravated by deep breathing, laughing, jarring or exertion, and was distributed through the back and shoulders. The patient had sustained a second injury a few days before coming for examination: a cow had kicked him in the chest.

The patient's height and weight were normal. His skin was slightly yellow. Roentgenograms revealed three periapical infections. There was restriction of motion in the spine; the sternum appeared prominent; the blood pressure was 130 systolic, and 70 diastolic; the pulse rate was 74. Urinalysis showed specific gravity 1.016, large quantities of albumin, and occasional hyaline casts and blood cells. The urine was examined several times and the Bence-Jones protein was constantly present. The

examination of the blood at various times showed the hemoglobin to be between 43 and 64 per cent, erythrocytes numbering from 2,000,000 to 3,000,000, and leukocytes from 5,000 to 7,200. The lymphocytes were 25 per cent, large mononuclears 2, transitionals 3, neutrophils 68.5, eosinophils 0.5, anisocytosis and poikilocytosis slight, and Wassermann reaction negative. The blood serum contained a true autoagglutinin. The temperature and pulse were normal during observation. The roentgenologist's interpretation was hypertrophic arthritis of the spine, and lesion of the eighth rib due to injury or myeloma. A diagnosis of multiple myeloma was made, based on the presence of Bence-Jones protein, secondary anemia, history, and roentgenograms. The patient has not been heard from since his discharge, August 13, 1923.

Case 13 (Figs. 6, 7 and 8).—A woman, fifty-three years of age, came to the Clinic September 3, 1921, because of rheumatism. She had been married twenty-eight years and had never been pregnant. She had had diphtheria and tonsillitis, and, in 1919, influenza. For the last three years she had had attacks of pain, swelling, soreness, and fever with occasional local redness of various joints of the body, which were diagnosed and treated as rheumatism. The patient was referred for treatment because the joints were stiffening. She had not walked for seven months, and had marked anemia and weakness.

At the time of examination, the patient was about thirty-three pounds underweight. The systolic blood pressure was 110, and the diastolic 70; the pulse rate was 120, and the temperature 98.4°. There was tenderness over nearly all the joints, and over the sternum. September 3, 1921, urinalysis revealed an acid reaction, specific gravity 1.016, granular casts, and occasional pus cells. September 6, examination of a twenty-four-hour specimen of urine (2,000 c.c.) showed an acid reaction, specific gravity 1.004, albumin 2, and occasional pus cells. The hemoglobin was 35 per cent; the erythrocytes numbered 2,390,000, and

the leukocytes 8,700. The differential count was polynuclears 50 per cent, small lymphocytes 37, large lymphocytes 11, eosinophils 1.5, and slight anisocytosis, poikilocytosis, and polychromatophilia.

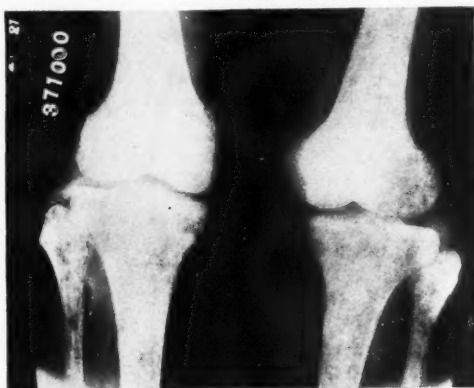


Fig. 8 (Case 13).—Multiple myeloma of the femur, tibia, and fibula

The blood culture was negative. Multiple areas of lesser density of the bones of the hands, ribs, skull, spine, and so forth, were evident in the roentgenograms. The tonsils were septic.

The patient was transfused September 10 with 500 c.c. of blood, and again September 27, and October 14. October 18, a tonsillectomy was performed. Daily urinalyses were made, and the Bence-Jones protein was found. Repeated blood tests indicated anemia. Culture of the urine and repeated cultures of the blood were negative. The neurologic examination was practically negative. The patient was in the hospital for seventeen days, during which time the temperature varied from 97° to 101°. An intramuscular phenolsulphonephthalein test showed a return of 38 per cent in two hours. The blood urea was 28, and urea nitrogen 13. The basal metabolic rate was +37 on October 5, and +57 on October 29. While the patient was in the hospital, swelling, pain, local heat, and tenderness suggested the possibility of arthritis. A diagnosis of polyarthritis of infectious origin and multiple myeloma was made. The patient died

February 3, 1922, about three and one-half years after the onset of the symptoms.

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DISCUSSION

DR. H. W. MEYERDING (Rochester, Minn.): In presenting these cases of multiple myelomas, seen and examined at the Mayo Clinic, I believe it is important to bring out the vague symptoms presented, which suggest rheumatism or neuritis. It is obvious that the X-ray is one, if not the greatest, aid in diagnosis. However, the presence of large amounts of albumin in the urine, together with vague symptoms of multiple myeloma, should be looked for, and for this reason, also, the Bence-Jones protein.

DR. LE WALD (New York): In regard to the distinction between the giant-cell tumors that are malignant and those that are not, I know what has been said is probably very true, that the broad differentiation between them might be made on the tissue between the giant cells rather than on the character of the giant cell itself, although Barrie, who has now passed away, held a very distinct opinion that the character of the giant cell itself and the number of nuclei told him which tumors were malignant and which were not. I would like to ask Dr. MacCarty¹ if he has seen cases of apparently benign bone tumors that have changed their character. We had one case that was distinctly a benign type, in the head of the tibia, and after a conservative operation the tumor went on and recurred, and the tissue from the recurrence was of a distinctly malignant character. Before operation that case had been observed about two years with no apparent change in the size of the tumor.

In regard to multiple myeloma, I think this paper is of great value, because it puts on record a large series of cases studied so carefully. Dr. Meyerding has classified the cases that might be confused with multiple myeloma, and he has also stated definitely that Bence-Jones protein may not be present in as high as 20 per cent of the cases. I think that is exceedingly important, because, as one goes about and sees cases examined, the clinician is apt to say that if the radiological appearance is reported as that of multiple myeloma and there is an absence of the Bence-Jones bodies, the radiologist probably is mistaken. I have had that experience and have had the satisfaction of following the case and proving it to be one of multiple myeloma. In that particular case, there was what he spoke of as remissions, which, in this particular instance, were alleged to be due to the giving of a special serum. I consulted Dr. Francis Carter Wood and he said, "Let them go ahead and give the serum if they want to;

¹Dr. MacCarty's paper on Pathologic Types of Bone Tumors has not been received for publication.
—EDITOR.

it probably won't do any harm." The explanation is, I suppose, that it stirs up some leukocytic reaction or something of that sort, but I think, from what Dr. Meyerding says, this was probably one of the ordinary remissions one sees. I have not had that particularly called to my attention before.

DR. A. W. CRANE (Kalamazoo, Mich.): I think that when you listened to Dr. MacCarty you heard one of the most interesting and luminous discussions of the malignant growth of bone that you are likely to hear anywhere. The question which arises from his classifications is whether or not there is any difference in the action of the X-ray on tissue in accordance with the degree of differentiation. Dr. MacCarty has already published a paper or two illustrating somewhat the action of the X-ray on the living cell. It has been my hope that some pathologist would show us in a diagrammatic way, picturing the cell walls, cytoplasm, nucleus, etc., and tell us what happens to that cell under the influence of the X-ray. I would be glad to know if such action can be shown on these bone cells.

When Dr. MacCarty spoke of having his limb amputated I wondered how much in earnest he really was. As many of you know, Dr. Codman, of Boston, and Dr. Ewing, who is a real pathologist, as I am sure Dr. MacCarty will admit, and Dr. Bloodgood, who clings to the problems of surgical statistics with a tenacity quite remarkable, have undertaken to register all bone sarcomata which have been examined or operated upon in the United States. They have accumulated an immense mass of material. At a recent meeting of this Society, at the Mayo Clinic, Dr. Bloodgood admitted to us that there was no known cure for bone sarcoma by operation. At the recent meeting in Boston, Dr. Ewing informed the Society that there was absolutely no hope of cure from operation upon any form of bone sarcoma, and said that if there is any cure to be obtained in the future, it will be by radiation therapeutics, and he did not think that was a very good hope. In view of the

opinion of those men, I am interested to know what Dr. MacCarty's real opinion would be if he had his own leg proven to be the seat of a malignant bone disease. Anyway, I hope the Doctor will consent to tell us what the action of the X-ray is on the different types of bone cells.

DR. MAX KAHN (Baltimore): In line with what Dr. Crane has just said as regards treatment of malignant bone tumors, Dr. Bloodgood has referred to me for deep X-ray treatment in the past two years a number of malignant bone neoplasms and I just want to speak of two of these cases at this time. One, that of a boy aged 16 years, had practically complete destruction of the left scapula, with extensive infiltration of the surrounding soft structures. Dr. Bloodgood felt that if he were to operate he would have to do a complete shoulder girdle amputation and then would not be certain that he had removed all of the neoplasm. This boy received his first deep X-ray treatment about two years ago, and I admit that the destruction of the scapula was so marked and the infiltration of the surrounding structures so extensive that I had little hope of helping him. After a course of treatment the bone gradually began to reform, and now, at the end of two years, the scapula is practically restored to normal, so far as we are able to tell. It resembles very much the opposite scapula; the infiltration of the soft structures has completely disappeared, and there is no demonstrable evidence of metastasis to the lungs. He is free of symptoms, feeling well and enjoying life the same as any boy of his age. We are not claiming this case as cured, but will follow him carefully.

Another case is that of a boy, aged 18 years, who had an injury to the femur in a football contest. Several weeks later a proliferating growth at the site of the injury was found, strongly suggesting a malignant neoplasm. Deep X-ray treatments produced regression of the growth and now, nearly a year and a half later, you can see very little evidence of it. The boy is enjoying

good health and indulges in all physical exercises and, so far as we can tell, is symptom-free of malignancy. We do not call this boy cured, but at least he is well and enjoying good health.

DR. L. R. SANTE (St. Louis): Only one question has come to my mind. I would like to ask Dr. MacCarty why different growths, composed of cells of apparently similar degrees of differentiation, react so differently to radiation. I refer to growths about the face; for instance, basal-cell growths and squamous-cell growths. I am sure that it is the experience of all that basal-cell growths yield readily to radiation, while squamous-cell growths are more resistant. Can this be explained on any basis of cell differentiation?

DR. MEYERDING (closing): The question of amputation in cases of bone tumors is always before us, and opinions with regard to it differ greatly. Unfortunately, pulmonary metastasis of these malignant bone tumors of sarcomatous type takes place irrespective of whether or not the limb is amputated. However, when the tumor is in such a position that it can be eliminated the patients may be relieved for several years before metastasis becomes evident in the lungs and the case terminates

fatally. For this reason I do not believe that we should condemn amputation. We should try to make earlier diagnoses, eliminate the primary tumor, and begin treatment without delay, in the hope of preventing metastasis. In dealing with multiple myeloma, which involves various bones, amputation, of course, is not to be considered.

It is obvious that the routine use of the roentgen ray in the examination of tumors of the long bones is most valuable in diagnosis. Furthermore, by its use the single forms of tumors of bone can usually be differentiated from the multiple, and the presence of pulmonary metastasis demonstrated before clinical signs are evident.

Dr. Campbell's careful survey of the findings in cases of bone syphilis are most valuable. One might bring out the value of roentgen-ray examination of the unerupted teeth and the changes of the epiphysis and epiphyseal line.

Dr. MacCarty has given us a remarkable conception of the phases of bone tumor. The terminology used with regard to bone tumors in the past has been very misleading, and probably was not understood even by the pathologists. I hope that Dr. MacCarty's classification may be generally adopted, and the nomenclature thus be simplified.

Esophagoscopy.—In cases of non-opaque foreign bodies in the esophagus, the author employs the following method: Small pieces of cotton-wool are teased out and soaked in bariumized cooked oatmeal. The patient swallows about six to eight of these bits of cotton, one at a time. A minute or so later he swallows an additional small quantity of bariumized oatmeal. Two or three minutes are then allowed for any surplus barium to leave the esophagus. Roentgenograms are then made and the position of the shadow of the wool mass held up around

the foreign body is then noted. The shadow is invariably cone-shaped. On passing the esophagoscope the lustrous white reflex from the upper part of the bariumized wool is readily detected. In every one of the author's cases of large haddock bone, the latter has been found closely invested by the wool, like a chrysalis in its cocoon.

SOLOMON FINEMAN, M.D.

Esophagoscopy: A Means of Detecting Foreign Bodies Non-opaque to X-rays. W. Frank Wilson. *Brit. Med. Jour.*, April 4, 1925, p. 656.

RADIO-ACTIVE SUBSTANCES AND THEIR THERAPEUTIC USES AND APPLICATIONS

RADIOTHERAPY OF BENIGN LESIONS OF THE FEMALE GENERATIVE TRACT

By JOSEPH MUIR, M.D., NEW YORK

IN November, 1922, the distinguished gynecologist, Howard A. Kelly, of Baltimore, made this pronouncement: "He who would give his patients the same consideration he would give his wife or his sister, must put radium first in the treatment of fibroid tumors. In uncomplicated fibroids, especially when associated with excessive bleeding, there is no treatment as satisfactory as radium. In our hands there has been, in several hundred cases, no mortality and the bleeding can be checked in almost every case. There is a consensus of opinion that radium treatment is applicable to small fibroids. I should like to go on record here to the effect that in a high percentage of the large tumors there is either a complete disappearance or a marked reduction in the size of the large growths." And he added, significantly, "The radiation as a rule in no way interferes with or makes more difficult, or contra-indicates, a later operation," if this should eventually prove necessary.

This statement, after an interval of almost three years, seems less radical than it appeared at the time it was uttered, but there are yet many gynecologists who regard the use of radio-active agents with distrust, and still maintain that their application should be restricted to those pathologic conditions for which surgery is of no avail. This attitude is more prevalent in regard to benign lesions than when the question concerns neoplasms which have been demonstrated to be malignant.

Yet months before Kelly took his unqualified stand in favor of radiating benign uterine growths we find another gynecologist of national reputation asserting that "the time has passed when we require extensive statistics and demonstration of cases to be convinced of the therapeutic value of radium and roentgen rays in fibroids of the

uterus. That fact has definitely been established. We know now that radium therapy and surgery are competing methods in the treatment of uterine fibroids, and it merely remains for us to determine which of these two methods to employ in a given case."

There are, of course, definite contra-indications to the use of radium in benign lesions of the uterus, but, on the other hand, as Taussig has put it, "Radium therapy of fibroid tumors is destined more and more to displace operation as patients learn to come early before contra-indications to its use have arisen." Agreement is, however, pretty general among those gynecologists who are most enthusiastic over the results of radium treatment as to the conditions which make its use undesirable. These may be considered under the following headings:

1. *Size.*—A tumor larger than a four months' pregnancy—more than 12 cm. in its average diameter—extending as high as the umbilicus, is more suitable for treatment by surgery than by radium. But there are cases on record where large tumors have been successfully irradiated, in patients who presented some grave contra-indication to hysterectomy or other surgical intervention. If the tumor is so large as to be producing pressure symptoms, the gradual reduction in size which radiation induces will probably be too slow, so that its surgical removal will be imperative. Moreover, if the size of the tumor is rapidly increasing, or there is evidence of calcareous degeneration, such a growth is unsuited to radium treatment. Pedunculated and subserous fibroids are very obviously better treated by surgery than by radiation.

2. *Location.*—If the fibroid is beneath the mucosa and protrudes through the cervix, or if it is subserous and of considerable

size, with a definite pedicle, or if it is wholly within a ligament, then surgical treatment will be found to give better results than the use of radio-activity. Zweifel considers any fibroids which are complicated with adnexal tumors, as well as those that press upon the bladder or rectum, as amenable only to surgery, but Taussig does not concur in this last assertion, considering these growths suited to radiation, "provided they are not already partly wedged into the pelvis," for in several of his personal cases such pressure symptoms entirely disappeared after the shrinkage produced by radiation had taken place.

3. *Evidence of Degeneration.*—If the menses are irregular or the hemorrhage is of such a character as to suggest malignancy, or indicate that much inflammation is present, the wisdom of radiation is doubtful. Of the various gynecologic conditions which react dangerously to the influence of radium, Graves considers that of pelvic inflammation to be of supreme importance. An old quiescent inflammatory focus may be relighted and greatly intensified after the insertion of radium tubes in the uterine cavity, "for, in addition to the injurious effects resulting from the presence of a foreign body in the uterus, there is added the devitalizing influence of the radium on the surrounding tissues, and the consequent reduction of their resistance to infection." According to Clarke and Keene, if there is cachexia out of proportion to the blood loss, this may be due to a necrosis of the tumor, which may be hastened by irradiation.

4. *Age.*—There is considerable variation in opinion as to the age most suited for treatment by radiation. Some state most emphatically that no woman under forty should ever be subjected to it. Crile, whose word carries great authority, but who speaks nevertheless as a surgeon and not as a radiologist, says that "in the child-bearing period, radium and X-rays should be used only in the treatment of cancer of the cervix, for since surgery relieves practically all cases and preserves the ovarian balance" there would seem to be "no ques-

tion regarding the use of surgery in the treatment of fibroid tumors within the child-bearing period, unless for some general reason the patient is not a good surgical risk."

Again, it is stated that there is no absolute contra-indication to radiation on account of age, except so far as the desire for children or a preservation of menstruation makes myomectomy or a subtotal removal of the body of the uterus preferable. Bland considers the dangers of radiation in young women at some length, for though in intractable bleeding in those patients radiation is finding a definite field of usefulness, its employment must be attended with the utmost caution. "The danger of establishing a permanent amenorrhea or premature menopause should be kept vividly in mind. If excessive doses are used, this unfortunate incident is highly probable, although *if small doses are employed* [*italics ours*] this unhappy sequel is very improbable." The menstrual flow can be readily modified and controlled by radiation. Small doses may cause temporary cessation, but in most instances it will be re-established after a few months, or even when as much as two years has elapsed. Temporary amenorrhea is the result of the destruction by radiation of the sensitive Graafian follicles as they are maturing; the less sensitive primordial follicles are not so affected. There is always a very real danger of sterilization even when the menstrual cycle is not interrupted. We do not find many records of women bearing full-term healthy children after radio-active substances have been applied to the uterus.

5. *Complications.*—Pregnancy is a decided contra-indication to the use of radiation of any kind, as abortion or deformity of the fetus is almost sure to follow. Pathologic intra-abdominal conditions such as cholelithiasis, appendicitis, or serious gastric lesions, if they exist, should first be subjected to appropriate treatment. It has been suggested that "in such instances, an exploratory incision should be made, thus giving a comprehensive diagnostic insight."

But though the abdominal lesion may require first attention, "this does not preclude an irradiation at the same sitting, if the myoma or myopathic cause of the hemorrhage falls within the class to which this treatment is applicable."

It should always be kept in mind that menorrhagia or metrorrhagia is seldom without complications in any woman who has passed the age of forty. The suggestion of malignancy is always very strong, and the most careful investigation of all such cases should be made before any treatment is applicable.

At the Sloane Hospital for Women, radium is used if the patient is over thirty-eight years of age, and bleeding is the important symptom; in younger women with definite myoma, where operation is contra-indicated, and in young women without myoma suffering from uterine bleeding associated with tuberculosis or other serious disease, where subsequent pregnancy would not be advisable. At this institution dilatation and curettage, followed, if necessary, by roentgen rays, are employed in young women in whom it is desired to cause a temporary menopause or a mere lessening of the flow. It is considered that even moderate doses of radium in the uterus cause sclerotic changes which predispose to dystocia, and for this reason, roentgen rays are regarded as preferable when there is a possibility of subsequent pregnancy.

INDICATIONS

Having carefully considered these various limitations, we are able, by process of exclusion, to set down a very definite list of conditions where radiotherapy is indicated:

1. In very small uterine fibroids at any age, if they are associated with bleeding, provided that they are not subserous and that no focus of inflammation is demonstrable in the uterine cavity; in women over forty, this applies to any tumor which does not rise above the umbilicus.

2. In metrorrhagia and menorrhagia of undetermined cause; also those known to be due to cystic oöphoritis; in menopausal hemorrhage and dysmenorrhea; in endocervicitis and cervicitis producing a leucorrheal discharge.

3. For "poor surgical risks," either because of constitutional disease or obesity, and for those who refuse operation through fear or for other reasons. It is also useful as a palliative, such as the checking of hemorrhage previous to operation.

As regards treatment by radiation, bleeding from the female urogenital tract has been divided by a recent writer into four different classes. These are fibroids, essential menorrhagia or hemorrhagic metropathy, bleeding following inflammatory adnexal disease, and, lastly, the pernicious bleeding during gestation. In regard to this last classification there may well be some difference of opinion. Roentgen radiation of the spleen was used by Bundy for bleeding following inflammatory adnexal disease as well as the pernicious bleeding during gestation. For this second condition the dose used was 15 per cent delivered to the spleen, and repeated in forty-eight hours if the hemorrhage persisted, giving this second time a two-thirds erythema skin dose.

PRELIMINARY PREPARATION

The application of radium in these gynecologic cases should be carried out with the same attention to detail and the same careful preliminary examination and preparation that are accorded to a surgical operation with a similar end in view. The patient should be kept in the hospital under close observation and due consideration given to the psychic aspect of every case. Corseaden advises "instruction of the patient in the nature of menstruation, the menopause and the symptoms to be expected," together with "an outline of what she may expect in the way of predictions and observations from friends, lay and medical," and "instructions as to her reactions toward these."

A careful preliminary pelvic examination under anesthesia should always be made; the dimensions of the uterus ascertained, measuring its depths with a sound; a diagnostic curettage with microscopic examination to rule out malignancy should never be omitted.

DOSAGE

The mode of applying radium varies at different hospitals, but all agree that the danger of giving too much is far greater than of not giving enough. Clarke and Keene use a 50 mg. tube, properly screened, which is inserted to the fundus of the uterus. The duration of application depends largely on the age of the patient; in women at or near the menopause, the duration is usually twenty-four hours, and in young women proportionately less. At the Sloane Hospital for Women, radium is given in doses of about 1,200 to 1,500 mgm. hours in women of forty or more, with the uterus and ovaries in normal relationship. The radium is distributed in small units "so as to minimize as much as possible the slough in the endometrium." The Dominici tubes which are employed are placed within rubber tubes 1 mm. thick. The same general rules apply to either radium or roentgen ray; "the only difference noted is that the roentgen rays are slower, especially in fat patients, and that radium is less reliable in large tumors. With intra-uterine application there is the added element of aseptic surgery and usually anesthesia."

At the Woman's Hospital in New York the radium applied in benign uterine lesions is screened as for the carcinoma cases, with silver, brass and rubber. The tube (100 mgm., preferably two 50's in tandem) is introduced into the cavity of the uterus above the cervix, and held in place with a narrow strip of gauze, and the vagina is likewise distended with gauze. The bladder is kept from distention by having the patient void often, or, if this is not possible, by frequent catheterization. Age is

the most important factor in deciding the amount of dosage. Fifteen to twenty-four hundred milligrams has been found sufficient to produce amenorrhea and shrinkage of the tumor. "In young women, where the aim is to check a dribbling flow without producing amenorrhea," from 200 to 600 milligram hours is considered sufficient.

TREATMENT OF HEMORRHAGE

When the application is made in women under thirty-five, in whom only a temporary checking of the menstrual flow is desired, a total of 600 millicurie hours—50 millicuries for 12 hours—is usually all that is wise to employ. For menorrhagia at the menopause 1,200 to 1,800 millicurie hours has been used. Radium emanation in little glass bulbs about $1\frac{1}{2}$ mm. in diameter, enclosed in small brass tubes 1 mm. in wall thickness and about 5 mm. in length, are used by Burnam at the Kelly Hospital in Baltimore. Three of these tubes are placed in a larger brass tube with walls 1 mm. thick, the apparatus then being sterilized and covered with beeswax. For a series of cases of young women under twenty-five, three-quarters of a gram-hour radiation with this apparatus did not establish permanent amenorrhea in a single case. By moving the sound when the fibroids are large, as much as three gram-hours' radiation has been given without evil effects. It was also found that by using a distance of three inches and radiating the pelvis through lateral portals over either ovary for a total of 10 gram-hours, an effect could be gained about equal to that of 1,500 mc. hours of intra-uterine treatment.

Avoidance of fistulæ can be attained by carefully immobilizing the radium emanation container, and keeping the patient as quiet as possible. A convenient container has been devised which is held in place by being attached to the cervix. The radium emanation is collected in a suitably screened cylinder which is provided with a wire handle long enough to be passed well up into the body of the uterus. The lower end

of this handle is pierced by suture holes, through which, by means of the regular cervix needles employed in gynecologic work, a suture is passed to the cervix and the container thus secured in the desired position. The uterus having been previously pulled down by the cervix, it becomes possible to make a special intra-uterine application to the corpus uteri alone, thus avoiding any chance of the rays reaching the vagina or rectum, an accident which—at the beginning of the therapeutic application of radium to gynecologic conditions—frequently produced most intractable vagino-rectal fistulæ.

The patient should always be hospitalized and kept upon her back for the entire period of treatment. If proper precautions are taken there will be no need to pack the vagina with gauze. Considerable technical skill and a thorough knowledge of uterine topography are required to make the application successful in every way, and this form of treatment emphasizes the absolute necessity of cordial co-operation between the radiologist and the surgeon or gynecologist.

In conclusion, we feel that we can confirm the observation of Clarke and Keene, who followed up three hundred cases in which irradiation for benign uterine conditions had been done, and after observing them for from three to five years were able to state unequivocally that "no single instance has come to our attention in which there was any remote deleterious result which could in any way be traced to radium." The treatment just outlined is of too recent application to enable us to make sweeping generalizations regarding the permanency of its curative effects, or the possibility of remote ill consequences from its application. But it certainly seems proved that radium emanation properly immobilized in the exact area of the endometrium

which it is desired to treat is a most desirable form of radium application, and in comparison with surgery undoubtedly brings equal, if not superior, results, at a fraction of the time, cost and suffering which the use of the knife invariably entails.

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CHRONIC APPENDICITIS: BASES FOR VARIED CLINICAL MANIFESTATIONS¹

By MORRIS I. BIERMAN, B.S., M.D., WASHINGTON, D. C.

IN the diagnosis of chronic ailments, especially those referable to the abdomen, it frequently becomes necessary to either diagnose or exclude chronic appendicitis as the chief, or one of the important, contributing factors of a lingering disorder. The physical examination in these cases is usually inconclusive. There

their origin, constitute the great majority of the signs, and give rise to the manifold confusing subjective symptoms.

Due to the complicated and rich nerve supply of the abdominal viscera, symptoms are frequently referred to non-offending organs. Clinical experience has shown that chronic appendicitis is frequently masked



Fig. 1. Reflex impairment of gastric function due to pylorospasm.

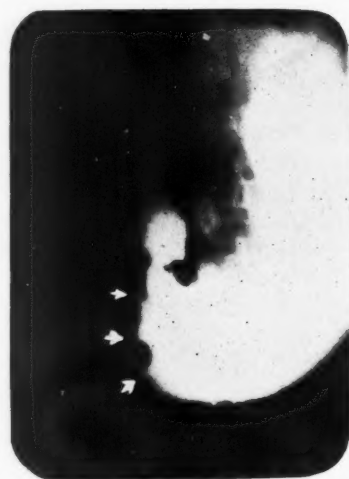


Fig. 2. Spastic deformity of antrum.

may or may not be a localized point of tenderness to palpation. The history may be of but little help. Then, to the end that a final and complete diagnosis be made, it frequently becomes necessary to require laboratory aid, and by its direct, visual methods the X-ray is of great value in obscure cases.

In the X-ray interpretation of chronic appendicitis reliance is placed upon two classes of signs, the direct and the indirect. The direct are due to anatomical changes which are the direct results of inflammation, adhesions, etc. The indirect, or functional, are spastic manifestations and are practically entirely reflex in character. They depend upon a focus of inflammation for

by what appears to be a chronic gastritis, a cholecystitis, or even a gastric or duodenal ulcer, and intensive study is required to rule out an organic lesion where it is not present. To this end the X-ray examination is of great importance.

The first of the sphincters showing the indirect or spastic phenomenon is that at the cardia, and it is best seen with the fluoroscope. Here, with the first few swallows, there is a spasm of the sphincter which stops the meal for a variable length of time, usually a second or two. This is associated with a sense of fullness or even slight pain behind the sternum.

A similar spastic manifestation of the pyloric sphincter leads to a small retention

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Fig. 3. Spastic deformity of duodenal cap.

in the stomach at the end of six hours, usually less than 10 per cent (Fig. 1). There results, therefore, considerable impairment of gastric function, which is entirely reflex in character. When the spasticity is not so marked, there is only some deformity of the antrum (Fig. 2), but this can be filled out by manipulation or relieved by an antispasmodic. Associated with this spasticity and the six-hour retention, as shown in the previous picture,



Fig. 4. Displacement of stomach downward and to the right; an attempt at immobilization of the right lower quadrant.



Fig. 5. Delay at the ileocecal valve at six hours.

there are frequently corresponding subjective symptoms of flatulence, anorexia, eructations, pyrosis, and even vomiting.

The duodenal spasticity is shown by the difficulty with which the cap is filled and by its irregularity. When the cap is deformed (Fig. 3) the deformity resembles that seen in ulcer, but this can be differentiated by the use of an antispasmodic such as belladonna.

In all inflammatory conditions there is a tendency of Nature to immobilize things in



Fig. 6. Spasm of ileocecal valve and ileum with delay in ileum at 24 hours.

the region of the pathology. Such an attempt at immobilization is well illustrated in the displacement of the stomach downward and to the right. The stomach is of normal size and contour, but assumes a

four hours. Figure 7 also shows delay in the terminal ileum at twenty-four hours due to spasm of the ileocecal valve.

When the obstruction is due to adhesions there is practically always found some de-



Fig. 7. Spasm of ileocecal valve with delay in terminal ileum at 24 hours.

position near McBurney's point, bringing pressure to bear on the organs in the right lower quadrant (Fig. 4). It is not pulled down by adhesions, as it can easily be brought back to its normal position, but as soon as the pressure of the hand is released it goes back toward the right lower quadrant. This is a very interesting phenomenon.

Frequently the first clue to the X-ray diagnosis is that at the six-hour examination the barium meal is seen to be delayed at the ileocecal valve and has hardly begun to enter the cecum (Fig. 5), and even the next day—24 hours after the ingestion of the meal—barium may still be found in the terminal portion of the ileum. The delay may be due to pericecal adhesions producing distortion of the cecum and the ileocecal valve, or to spasm of the ileocecal valve and a small portion of the ileum. Figure 6 shows marked spasm of the ileocecal valve and the last inch or two of the ileum, with consequent delay of the meal at twenty-



Fig. 8. Adhesions involving cecum and terminal ileum with resultant 24-hour delay in ileum.

four hours. The coils of the ileum may also be involved in this process (Fig. 8). The cecal deformity produced by the adhesions usually results in its fixation, so that it does not have the movability which the normal cecum has. The delay of the meal at the ileocecal valve gives rise to such subjective symptoms as a sense of burning in the right lower quadrant, pain in the same region or even in the epigastric or umbilical regions, vague abdominal discomfort, etc. Occasionally, reflex vomiting is also present.

In Figure 9 there is seen marked distortion of the haustrations as well as an increase in their number. They do not have the even regularity of the normal colon. This increased spasticity is reflexly due to a focus of irritation, in this case a chronically inflamed appendix. Occasionally, spasm may simulate organic disease of the bowel. Figure 10 shows a spastic deformity which resembles an annular carcinoma of the transverse colon. However, the barium enema (Fig. 11) showed the colon

to be perfectly normal, and the suspicious area to be well filled out.

There seems to be a tendency to regard the appendix as a useless, non-functioning organ. It may or may not be a useful



Fig. 9. Deformity of colon due to reflex spasm.

organ, but it certainly is a functioning one. The appendix fills and empties at fairly regular intervals. The filling is probably by mechanical pressure during a period of relaxation. Its emptying is by definite, very slow peristalsis, probably similar to

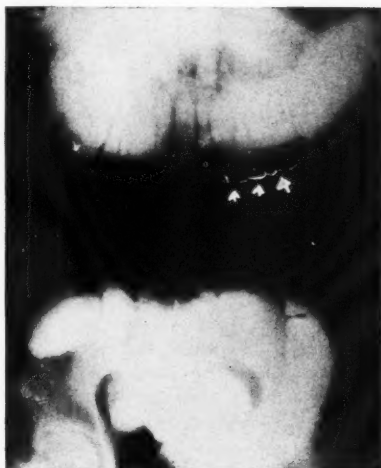


Fig. 11. Same case as Figure 10, showing barium enema. Colon entirely normal.

that of the large bowel. Figure 12 shows segmentation of the appendix at regular, definite intervals. These constrictions represent four peristaltic waves. This shows, then, that segmentation represents peristalsis in the appendix. The roentgenogram taken the next day showed the appendix partially emptied and in a state of relaxation.

When a sub-acutely inflamed appendix has quieted down, or when the condition has



Fig. 10. Spasm of transverse colon simulating carcinoma.



Fig. 12. Constrictions in appendix due to peristaltic waves.



Fig. 13. Retention in appendix when cecum is empty.

been chronic from the beginning, the picture is modified somewhat by the structural changes which have taken place in the appendix and surrounding tissues. Here, instead of definite, regular, efficient peristaltic activity, peristalsis is deficient, and the emptying time is consequently extended, so that the appendix does not empty itself simultaneously with the cecum. Just how long it will take for the appendix to empty itself will depend upon the amount of dam-

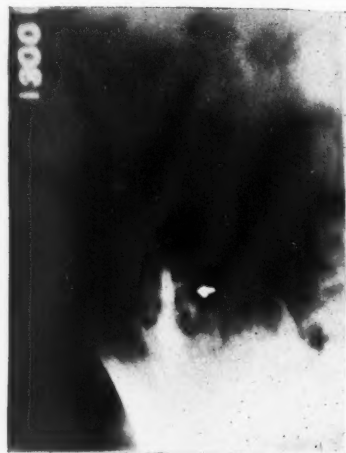


Fig. 15. Retention in retrocecal appendix.

age sustained, its degree of fixation, etc. Occasionally, an appendix will be found which contains barium a week or even more after the cecum has emptied (Fig. 13).

It is not at all unusual to find the appendix retrocecal and fixed there; in this condition it cannot be seen until the cecum is at least partially empty, and this may take two or even more days (Fig. 15). Even in this position, where one would expect gravity to help empty the appendix, there is frequently retention for days. It is obvi-



Fig. 14. Retention in appendix and concretion near tip.



Fig. 16. Retention in appendix; note weak peristaltic waves.

ous, therefore, that efficient peristalsis is absolutely essential for its proper emptying.

Pain on pressure over the cecum is a very important help in the diagnosis. While

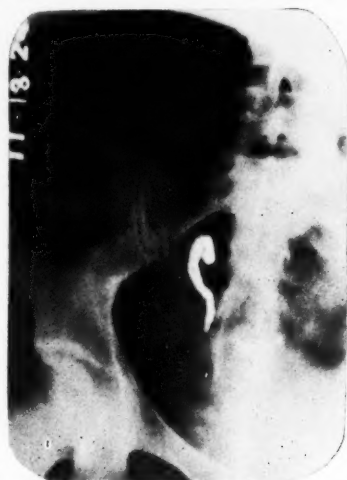


Fig. 17. Same case as Figure 16; retention four days later.

the clinical datum of pain is not entirely within the realm of the roentgenologist, yet

its presence and localization over the cecum or appendix is extremely important (Fig. 16). The pain must be definite and should be differentiated from the discomfort caused by the pressure. Comparison with the left side will serve to differentiate this type of pain. The pain must be constant and not vary from day to day. During the examination of some patients they will complain on one day of considerable pain over McBurney's point on deep palpation, and the next day it will be found that great pressure can be made over this region without the least discomfort. This is accounted for by varying degrees of intracolonic pressure. When the cecum is full and deep palpation is made, there is immediately increase in the intracolonic pressure within the already distended cecum. Increasing the distention in this manner gives rise to pain. On the following day the cecum may be practically empty and deep palpation will give rise to no discomfort whatever. This point is extremely important.

The erythema dose.—The German erythema dose is described as a dose which gives an erythema, or reddening of the skin, within a certain time limit, which varies with the different authors. The French erythema is a radio-epidermitis, or second degree burn, which heals and re-epidermises without leaving a scar. According to Solomon, this phenomenon always occurs when the dose of 4,000 R is employed, as measured by his standardized iontoquantimeter.

Measurements were made on Veifa Neo-intensive apparatus with constant current condensers

without kenotrons, and the Siemens and Halske, Stabilivolt, with four condensers and four kenotrons. Comparing the results of the measurements, the French erythema dose was found to be approximately three times that of the German.

J. D. CAMP, M.D.

A Comparison between the French and the German "Erythema Dose" as Measured on the Solomon Iontoquantimeter. Ira I. Kaplan. Am. Jour. Roentgenol. and Rad. Ther., Nov., 1924, p. 464.

CASE REPORTS AND NEW DEVICES

DIAPHRAGMATIC HERNIA

By CHARLES FORD, M.D., CHICAGO

This case proved to be extremely interesting, because of the comparatively few symptoms present. The patient, having an extensive diaphragmatic hernia, did not consider the symptoms caused by it as of enough importance to mention, and they were elicited from her only after the presence of the hernia had been proven by X-ray examination.

A synopsis of the final history of the case is as follows:

Female, white, age 26, married 3 years, no children, occupation housewife. Family history negative. Past history of no importance, until four years ago, when she was injured in an automobile accident, from which she was confined to a hospital for several weeks with a fractured pelvis. (Subsequent radiogram shows a healed fracture of the left ischium with separation of symphysis pubis; position fairly good.) At the time, she complained of severe pain in her left chest, which was strapped with adhesive strips, and evidently not thought of enough importance to radiograph, as radiographs were made only of her pelvis. For several days after her accident, she had difficulty in taking nourishment, being able to take only a spoonful at a time. She evidently made a good recovery from her accident, and has felt well since, excepting that she could take only a small amount of food at a time. She has become nauseated on several occasions, but was unable to vomit.

Present illness: The ailment which caused her to seek medical advice (February 4, 1925), was a paroxysmal cough, which had been coming on several times a day over a period of about two weeks.

Physical examination: Medium height, slender, well nourished. Chest examination negative, except for a slight tympanitic

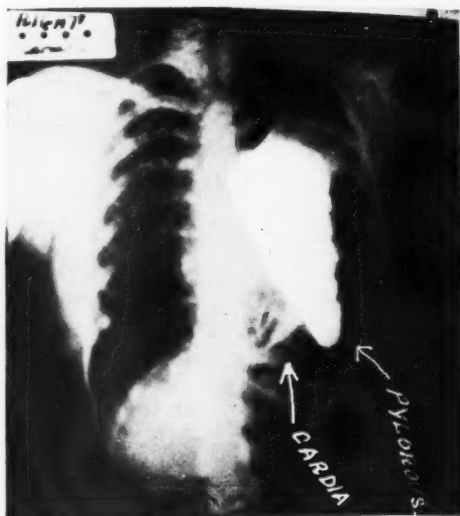


Fig. 1. Showing stomach shortly after ingestion of meal. Splenic flexure, filled with gas, is shown external to the stomach.

note over left thorax. The chest was X-rayed stereoscopically as a matter of routine. The radiograms showed two air-filled cavities in the left chest, the larger cavity being internal to the smaller one. Close examination revealed normal lung markings within the outlines of the cavities. It suddenly occurred to us that the outline of the larger cavity resembled a stomach, and on looking for the normal *magenblase*, it was found to be absent from its normal location. The patient was called back for more thorough examination to rule out diaphragmatic hernia.

The fluoroscopic examination revealed the same as the radiograms, except that there was a distinct fluid level across the lower third of the larger cavity. Deep inspiration showed no limited motion of the left chest or diaphragm. An opaque meal was given, which showed a normal esophagus, the meal going through and forming itself into a small rounded mass just under

the diaphragm. After drinking about four ounces, she stated that she had reached her capacity. On lying down, the opaque media was seen to immediately go back through another opening in the diaphragm, and into

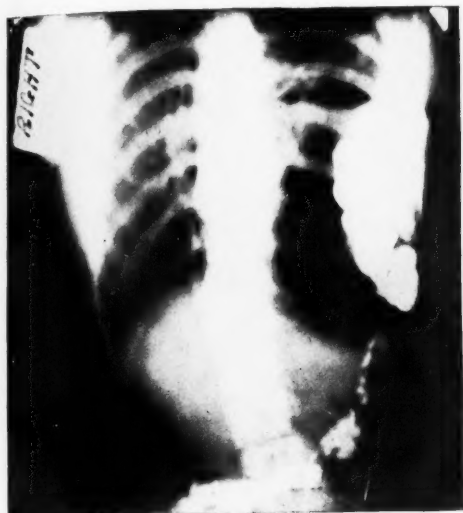


Fig. 2. Twenty-four-hour plate, showing more than twelve inches of colon, including the splenic flexure, above the diaphragm. Stomach seen to be filled with gas.

the larger cavity, which proved to be the stomach, which reached to the level of the third rib. The meal was given piecemeal. She would drink a small amount, and then lie on her right side for a moment, when she could drink some more.

In shape, the stomach resembled a large horseshoe; the greater curvature comprised the upper surface. All food had to pass over the curve, and the only way this could be accomplished was for the patient to lie down. The part of the meal which had passed the curve was seen to empty very rapidly when the patient assumed the upright position. The smaller cavity, just external to the stomach, proved to be the splenic flexure, the amount of colon in the hernia being a little more than twelve inches. This would indicate a fairly large opening through the diaphragm. The stomach and loop of colon were in the anterior part of the chest, and had caused no collapse of

the lung or displacement of the heart. The lung markings could be traced down to, and conformed with, the outline of the diaphragm. There would have to be a compression of the lung from before backward, when the stomach was full, but this caused no difficulty in breathing, as might be expected.

The cough, which caused the patient to seek medical advice, cleared within a few days, and probably bore no relation to the hernia. The woman leads an active life, and is suffering no discomfort from the hernia, except difficulty in taking food. She feels well, and probably would have remained unaware of the presence of the hernia had it not been for the incidental discovery during examination for another ailment.

ISOLATED DISEASE OF THE TARSAI SCAPHOID (KOEHLER'S DISEASE): END-RESULTS IN TREATED AND UNTREATED CASES

By FREDERICK E. DIEMER, M.D., and FRANK E.
BUTLER, M.D., PORTLAND, ORE.

Many have reported cases of isolated disease of the tarsal scaphoid, but, apparently, none have considered their cases from a viewpoint of functional end-results. We wish to report one case from its incipency to its termination, careful, painstaking treatment being carried out during the interim.

Two other cases of undoubted Köhler's disease, which were untreated, are reported in order to demonstrate the function of the scaphoid, its shaping after untreated recovery, and the consequent end-results.

The function of the scaphoid is that of a multiple keystone, supporting the weight distributed between the distal ends of the metatarsals, the os calcis and the cuboid. This bone is, therefore, subjected to stress from all sides (except from the superior aspects) when weight is placed upon the foot.

We know that any bone, according to an interpretation of Wolff's Law, assumes a



Fig. 1. Case 1, before treatment.

shape compensatory to its added function and changes its minute structure to conform, after a definite change in its normalcy. The tarsal scaphoid ossifies from two centers. Frequently the two portions of the



Fig. 2. Case 1, after treatment.



Fig. 3. Case 2, showing the deformity resulting from non-treatment.

scaphoid do not unite. A divided scaphoid is afterwards discovered inadvertently by means of the roentgen ray, and consequently not a great deal of significance is placed upon it.

Now comes our theory of the condition first described by Köhler and interpreted by many as due to pyogenic infection. Wolff first explained bone changes following injury to the cartilage between the epiphysis and the diaphysis. We believe—and our belief is substantiated by the following case reports—that an injury to the center of ossification of the scaphoid produces a definite change in the shape of the bone and definite abnormality in its ossification.

The accompanying radiograph (Fig. 1) of Case 1 demonstrates that the bony scaphoid is much flattened, but that there is marked space between the scaphoid and the astragalus, and the scaphoid and the internal cuneiform. It demonstrates also that

the density of the bony portion is decreased, indicating a lack of normal function of the ossification centers. Therefore the spaces are occupied by cartilages lacking the bone-forming function because of injury to the



Fig. 4. Case 3.

centers of ossification. The injury to the centers is due not to pyogenesis, but to violence. The pain, local swelling, and redness are easily explained without the consideration of infection. Again, the process occurs only in childhood and would therefore be classed as mechanical rather than infectious. Also, the tarsal scaphoid is the only small bone ever involved in a process of this nature, and when its function is remembered the explanation is simple.

Case No. 1. J. C., age five, appeared for examination in July, 1919. Complaint: pain in right foot when active. Examination revealed slight redness and swelling over dorsum of right foot. Temperature normal. Blood count normal. No evi-

dence of any systemic trouble. Family history negative. Radiographs revealed the right tarsal scaphoid to be flattened, with a markedly increased radiability. Cartilages on either side of bone normal. Roentgen diagnosis Köhler's disease. Cast was applied and kept on foot for a period of eight months and radiographs made frequently. Cast was left off only after radiographs revealed the scaphoid to present a normal density and a normal configuration (Fig 2).

The untreated cases (Figs. 3 and 4) found in adults presented an entirely different aspect. Because of the continued forces applied to the bone in question, its shape assumes that of a wedge with the apex of the wedge externally and inferiorly situated. There is observed to be a rearrangement of the neighboring bone to conform to the different function of the scaphoid. The foot is flat. We have never seen this condition occur bilaterally.

Cases 2 and 3, both adults, give the classical history of "isolated disease of the tarsal scaphoid." We consequently suggest that the classification of this condition be termed "osteogenesis imperfecta juvenilis navicularis."

NEEDLE PERFORATING THE DUODENUM¹

By RALPH B. BETTMAN, M.D., Associate Attending Surgeon, Michael Reese Hospital; Instructor of Surgery, Northwestern University, and ARTHUR R. BLOOM, M.D., Fellow in Radiology, Michael Reese Hospital.

The patient, M. M., female, aged 27 years, was referred to us by Dr. Irving Stein. She complained of epigastric distress of an indefinite nature of about a year's duration which consisted essentially of a feeling of fullness and weight in the epigastrium. Three weeks prior to examination she began having distinct pains in the epigastrium, coming on about an hour after meals, and only slightly affected by alkalis. One week later she had an attack of acute knife-like pains in the epigastrium,

¹From the Surgical and Radiological Departments of Michael Reese Hospital.



Fig. 1. Film of gall-bladder area showing needle about level of second lumbar vertebra.



Fig. 2. Film of barium-filled stomach showing the needle. This and other views in which the patient was rotated showed the needle in contact with the duodenal cap.

associated with nausea and vomiting. She had chills and thought that she also had a fever. The pain at this time was paroxysmal and radiated along the right costal margin and backwards to the right scapular region. There was no history of jaundice. Except for occasional headaches the history was otherwise negative.

The physical examination was irrelevant except for tenderness in the gall-bladder and over the appendiceal regions. There was no muscle rigidity or spasm. The temperature, pulse, respiration, blood counts, urine and stool examination were normal.

X-ray examination disclosed the following: Fluoroscopic examination with opaque meal revealed a normal orthotonic stomach emptying in five hours. The bulbous duodenum showed a normal contour except for a shallow depression or "gall-bladder seat" and filled readily. At 24 hours, the barium had reached the rectum. The appendix

could be visualized in the right iliac fossa and was exquisitely tender on palpation. At 48 hours, the colon was practically empty. The appendix could no longer be visualized. The films confirmed the fluoroscopic findings throughout and disclosed, in addition, what appeared to be a needle in the vicinity of, or projecting through, the bulbous duodenum (Figs. 1 and 2). The roentgenological findings otherwise were consistent with a chronic appendix.

The pre-operative examination led us to the following diagnosis, *viz.*, foreign body, probably a needle, perforating the duodenum, chronic appendicitis, and probable cholecystitis. Exploratory laparotomy was advised with the expectation of removing the appendix, removal of foreign body, if found, and attention to the gall bladder if

the appearance of this organ indicated abnormality.

At operation the stomach and duodenum were found to be normal. A few adhesions of recent origin were found extending over the first few centimeters of the duodenum. Projecting through these adhesions and free in the peritoneal space was the first centimeter length of the needle. The second two centimeters lay embedded in the adhesions and the last centimeter in all probability must have been in the lumen of the duodenum. There was no evidence whatsoever of an acute inflammatory reaction.

The needle (Fig. 3) was removed. The gall bladder appeared normal in every respect. A typical "chronic appendix" was removed through a secondary McBurney muscle-splitting incision. Convalescence was uneventful. After the operation, on close questioning, patient denied all knowledge of having swallowed a needle.

This case presents unusual interest because of the uncommon occurrence of perforation of the gut by a swallowed needle. As an almost universal rule, pins and needles which have been swallowed invariably pass through the alimentary tract without perforation or impaction and without producing symptoms. We have had an opportunity of seeing a large number of cases of swallowed pins and needles, but this is the first which, to our knowledge, has perforated or lodged.



Fig. 3. The needle which was removed at operation (actual size).

It is a question as to how much the symptoms in this case can be attributed to the foreign body, as practically all of them can be accounted for by a chronic appendix.

No attempt has been made by us to go into the literature extensively on this subject, but it is interesting to note that Knazovicky reports a case in *Bratislavské Lekárske Listy*, Praha, 1923, III, 81, in which the history of the case, symptoms, and findings were practically identical with the above.

GIGANTIC HYDRONEPHROSIS WITH HYDROURETERS, CONGENITAL

By E. H. KESSLER, A.M., M.D., St. Louis, Mo.

Very large ureters, with the usual large kidney pelvis and calices, are seen frequently enough, occurring on one side. A careful examination will usually disclose some obstruction in the urinary tract, either a blind end of the ureter leading into an abnormal position, such as the rectum, or an imperforate anus. Tumors, strictures, and inflammatory conditions may cause obstruction, anywhere in the urinary tract, to the flow of urine through the ureters. Supernumerary kidneys, with displaced, dilated ureters, have been found. In fact, any obstruction sufficient to hinder the flow of urine through the urinary tract will dilate the obstructed area. Proven congenital cases of hydronephrosis and hydroureterosis are rare. Wilhelm Tinnemeyer (*Zeitschrift für urologischen Chirurgie*, 1922, p. 50) mentions Gerster's case of horse-shoe kidney, with a very large left ureter leading into an imperforate anus. In the same article (p. 58), the postmortem of a male child thirteen days old is reported as showing ureters the size of a lead pencil, with kidneys larger than normal. At the entrance of the ureter into the bladder only the thinnest filiform bougie could be passed.

Braasch has reported a case of hydroureterosis and hydroureterosis as follows: "The dilatation is marked from the meatus to the renal pelvis. The dilatation in the pelvis is predominately in the calices; no

obstruction is found; the condition is evidently one of congenital atonic development." Again, the same authority mentions a case of solitary kidney with a large ureter.

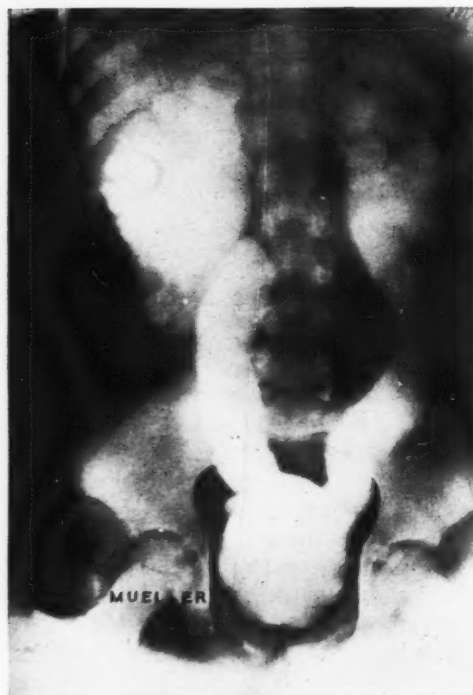


Fig. 1.

I wish to put on record the following case:

Male child, white, ten years of age, was admitted to the hospital on October 1, 1923. He was a well-formed child of normal size, giving an impression of being healthy. The family history was good and the brothers and sisters of the patient were well. He had weighed nine pounds at birth; had had measles and mumps in early childhood. About five years before the date of examination the mother had noticed some pus in the boy's clothing. Shortly after this he began to suffer with nocturia and a little later incontinence began, which was exaggerated during excitement. The child continued to look well and did not complain.

At this time he was examined by physicians, but without benefit. One year later the boy contracted whooping cough. The pus from the urethra became plentiful, and for a time the boy seemed weak and to lose desire to play. At this time cystoscopic and X-ray examinations were made, the diagnosis being a stone in the prostate. The plate showing the supposed stone was shown me by the father; the shadow seen is that of the child's penis.

Dr. Lund found on cystoscopic examination, under general anesthesia, normal external genitalia, slight cystitis, no tumor or foreign body. The orifices of the ureters were wide open and would probably have admitted a finger. A catheter passed freely on both sides. A free cloudy drainage was obtained, which, in culture, showed no growth. Palpation of the prostate, with finger in the rectum, revealed nothing abnormal. The microscopic examination of the urine showed pus 4+, mucus 4+.

The child was given urinary antiseptics, and his parents told to bring him back later. On February 20, 1924, it was decided to make a pyelogram. Because of the wide open ureteral orifices the opaque solution was injected into the urinary bladder, to find its way into the kidneys by gravity. Two hundred and seventy-five c.c. of 15 per cent sodium bromide was used. Elevating the pelvis, the urinary tract was exposed for X-ray plates, with the following results:

The outline of the bladder had a serrated edge for the entire circumference, possibly due to the use of too little sodium bromide. The ureters were filled, averaging one and one-fourth to one and one-half inches in width, the right ureter, three inches below the pelvis, showing a reduplication or folding on itself. The right kidney showed a filled pelvis and calices the shape of a bare foot with the heel to the bottom, this heel being about three inches wide. The widest part was four and one-half inches, with each calyx about one and one-fourth inch. The left kidney showed a very large pelvis with three large calices,

not entirely filled. The pelvis was about three times the normal size, and the left ureter was about one-fourth inch smaller than the right.

The child was treated by pelvic lavage and urinary antiseptics for about ten days, when he developed a contagious disease for which he was sent to quarantine. Returning from quarantine he caught cold and developed pneumonia, from which he died on the third day.

POSTMORTEM FINDINGS

The bladder was of normal size and capacity. The ureters, originating at the normal location, were about one and one-fourth inch in diameter and the walls approximated those of the bladder in thickness. There was a half-inch constriction near one kidney. Both ureters were dilated to a funnel shape, forming a rather large kidney pelvis. The kidney substance was about normal in amount for the age of the patient and fetal lobulation persisted. Kidney section showed fibroadenoma.

A CASE OF CONGENITAL ABSENCE OF THE ESOPHAGUS

By E. B. KNERR, M.D., Radiologist for Research Hospital, KANSAS CITY, MO.

A condition of congenital absence of the esophagus occurred in the case of Baby S., born at Research Hospital, February 13, 1925, in the service of Dr. Benjamin Jacobs, of Kansas City, Mo.

The babe weighed four pounds and eleven ounces at birth and appeared normal in all respects, though estimated from history to be from four to six weeks premature. The babe nursed at breast late the first day and the morning of the second day, but the milk was returned with much mucus. Thereafter the babe refused to nurse and all attempts at artificial nourishment were unsuccessful. The child would swallow from a dropper, but in a short while whatever had been given would be

regurgitated. Small doses of atropine were administered at intervals to overcome any possible spasticity of the esophagus, but with no apparent effect. The weight of the child gradually declined until it had

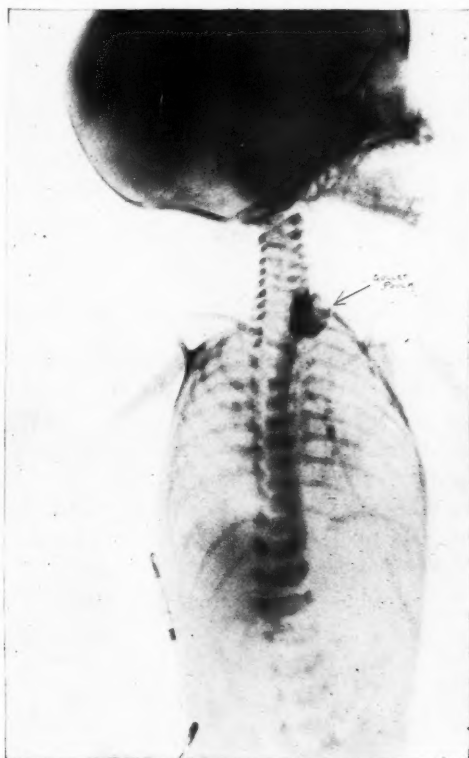


Fig. 1.

dropped to three pounds and ten ounces on the ninth day, when the babe died. Urine was voided and stools passed on the second day.

On the eighth day after birth a few grains of barium sulphate were mixed with a half dram of the mother's milk and a little sterile water and this was given to the child from a medicine dropper. The swallowing and course of the barium was observed under the fluoroscope and was seen to pass to the level shown in the accompanying plate (Fig. 1), where it appeared to be distributed as in a pouch. No extension of the lumen of the esophagus could be

demonstrated by varying the position or posture of the subject under the fluoroscope.

The plate herewith was made one-half hour after the giving of the barium. A plate made immediately after the barium was given presents the same picture of a pouched atresia of the esophagus at the level of the upper border of the manubrium, indicating an almost total absence of the gullet.

Consent for autopsy was not given.

ANESTHESIA LIGHT FOR FLUOROSCOPIC ROOM

By A. H. STALL, M.D., City Hospital, AKRON, OHIO

I have many times been impressed by the need for illumination in order to properly observe a patient under anesthesia during fluoroscopic work. Continually turning the light off and on or using a flashlight retards the operator's vision. Continuing the anesthetic in total darkness is a risk to the patient and a responsibility to the anesthetist that I would not care to assume. With this thought in view we have devised the following arrangement which we are using and find satisfactory to all concerned.

We built a wire skeleton 22 inches long and 17 inches in height, at the ends of which are two lateral wings measuring 9 inches at the base and 4 inches at the top. In the center and base of the 22x17 structure we cut an aperture measuring 10 inches



Fig. 2. Apparatus with light cover removed.

wide and 7 inches high. This is to fit over the patient's neck. The edge of this neck aperture is covered with rubber tubing. An electric wire is attached in either upper end. In the light socket we use a 10-watt carbon bulb. To control the light we took a metal cylinder $3\frac{1}{2}$ inches long by $1\frac{1}{4}$ inch in diameter, closing one end by soldering metal over it, then cutting a small aperture about a half-inch in diameter near the closed end. This cap slips over the small light bulb and can be used to govern the rays of light emitted.

With the wiring attached, the entire frame is covered inside and out with a flat black cloth of enough body to absorb all light, a loose piece being left over the aperture for the patient's neck, to guard against rays of light being thrown in the operator's eyes.

This gives enough light so that the anesthetist may at all times see her patient or

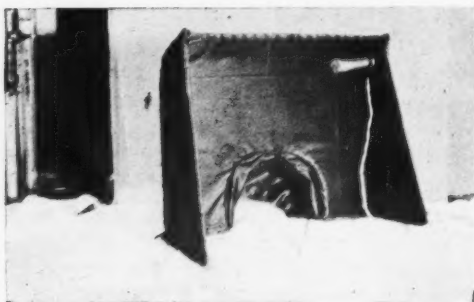


Fig. 1. The apparatus complete.

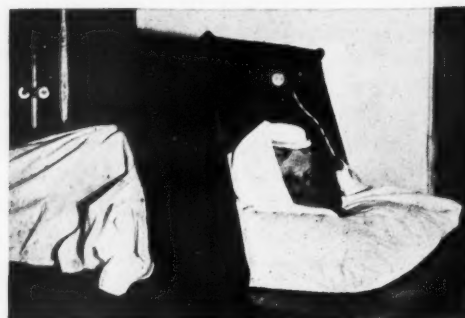


Fig. 3. Apparatus covering patient while in use.

gas apparatus, and yet in no way does it hinder the operator, with his eyes "fixed," by having light continually flashed on and off.

CASE OF INFECTIOUS ARTHRITIS

By N. J. NESSA, M.D., Sioux Falls Clinic,
SIOUX FALLS, SOUTH DAKOTA

The patient is an American woman, aged 60. Her mother died at the age of 76, of la grippe; her father, of pulmonary tuberculosis, at 51; brother, at 84, following operation, the nature of which is not known, and sister, at 22, of pulmonary tuberculosis. The patient was married at the age of 21; has one son, aged 35, in good health; no miscarriages. Her husband died at the age of 54, of apoplexy.

Previous Sickness.—Erysipelas, 1907-1909; good recovery.

Present Complaint.—On March 13, 1921, while walking on crutches she fell and fractured the right humerus in the distal third. Was under care of Dr. E., who referred patient for X-ray examination. Fracture showed no evidence of union. Patient is crippled, wheeled about in a chair, although she can walk to some extent with crutches. The following history was obtained: Before her marriage she

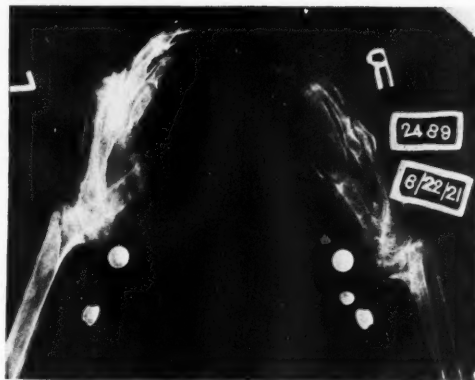


Fig. 2. Hands and wrists, lateral view, showing dislocations.

had a slight attack of pain about the right shoulder. Several years later she began having swelling and pain in the finger joints, followed by deformity. A year or two later, the same condition was noted in the feet. Since her marriage, which occurred, as noted above, at the age of 21, the disease has been more or less progressive, involv-

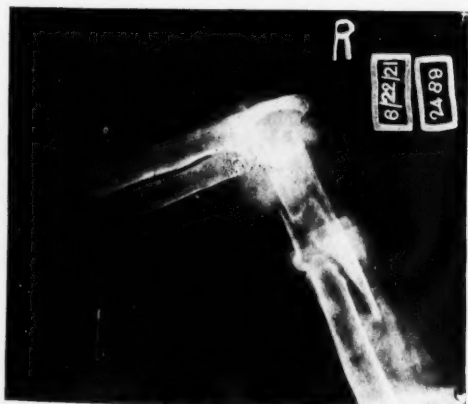


Fig. 1. Traumatic fracture of right humerus, showing associated destructive lesion of elbow joint.



Fig. 3. Anterior-posterior view of left hand showing dislocations and deformities of phalangeal joints.

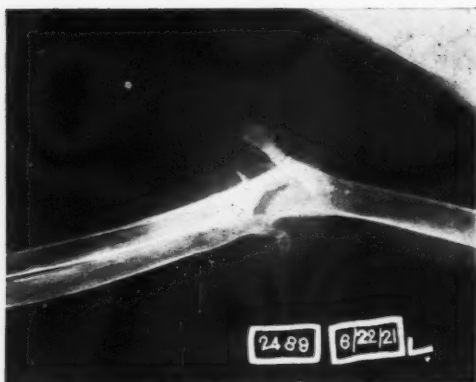


Fig. 4. Anterior-posterior view of left elbow showing destruction and absorption of articular parts.

ing all joints. In 1904, soft nodular enlargements appeared about the knees, elbows, and other joints. She is now quite helpless, chair-ridden, although she is able to employ her hands in knitting.

Physical Findings.—Her present weight is 93 pounds. Complete ankylosis of the



Fig. 5. Bony ankylosis of left knee joint.

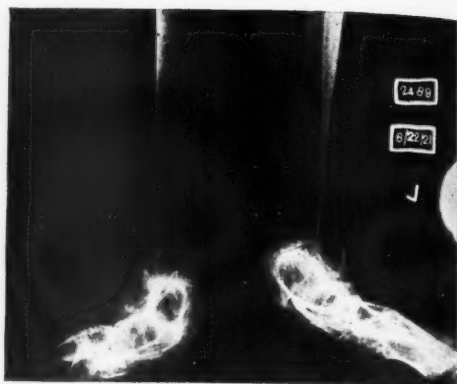


Fig. 6. Feet, showing joint destruction and resulting deformity.

knee joints, as well as joints of the feet. Elbow and finger joints are flail, with nodular protuberances. Systolic blood pressure is 220; diastolic, 110. Urine and blood, including Wassermann, negative.

This patient was sent in for X-ray examination of the right humerus, but for clinical study all joints were roentgenographed (Figs. 1 to 6). X-ray report on the right humerus shows fracture in the distal third, with apparent non-union. Elbow joint below fracture has practically disappeared. The hands, radius and ulna, as well as foot and ankle, all present a picture of the end-results of infectious arthritis. Knee joints show bony ankylosis; hypertrophic bone changes involving hip joints and spine in general.

Diagnosis (made by Dr. J. C. Bloodgood).—Osteomalacia group; perhaps osteoporosis due to calcium deficiency secondary to joints; chronic polyarthritis, infectious group.

DEPARTMENT OF RADIODONTIA

UNDER THE SUPERVISION OF BOYD S. GARDNER, D.D.S.,
ROCHESTER, MINNESOTA

SAFEGUARDING THE PATIENT AND X-RAY TECHNICIAN FROM INFECTION IN RADIODONTIA

By BOYD S. GARDNER, D.D.S., Section on Dental Surgery, Mayo Clinic, ROCHESTER, MINNESOTA

IT is very apparent that this is an opportune time to call the attention of physicians and dentists to the possibility of infecting one patient from another in the process of exposing dental films. Not uncommonly there are secondary, and occasionally primary, syphilitic lesions in the mouth that are not always recognized even by physicians, let alone laymen, who are employed to make exposures of such films. It has been the practice in the Mayo Clinic for several years to follow a definite procedure in order to eliminate the possibility of infecting, not only the patient, but the operator. It is assumed that the films come from the manufacturer fairly clean, or it would be necessary to sterilize them as the boxes are opened. The operator uses rubber gloves and does not change for each patient unless the condition of the mouth is

questionable; however, the gloved hands are washed with a liberal amount of soap and water followed by alcohol for each case. After the film has been exposed, it is laid on a sterile towel, and after exposures for the entire mouth have been made, the films are delivered to the dark room, the dark room operator taking precautions to safeguard himself. Between patients, everything that is touched by the operator's hands is wiped with a 40 per cent solution of alcohol and allowed to dry. Since this procedure has been instituted, there has not been even a suggestion of any kind of infection which could have been traced to X-ray technic.

The foregoing precautions are more important when films are placed in the mouth directly after operation, as the opportunity for infection is naturally greater.

EDITORIAL

M. J. HUBENY, M.D. Editor
BENJAMIN H. ORNDORFF, M.D. } . Associate Editors
JOHN D. CAMP, M.D. }

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ROENTGENOLOGIC INTERPRETATIONS DIFFER. WHY?

According to Einstein we can't help it; so therein we have an excuse, at least. The same object viewed by several individuals differs in place, size, shape, color, weight, texture, value; in short, in every conceivable aspect. Furthermore, the same object is never the same again, even to the same person, because he is not the same person he was, and he views the object under different conditions of age, light, position, experience, *et cetera*.

This accounts partly for differences in interpretations. Another factor of interpretation is the reasoning power of the individual. Reason, as such, in some cases, is greatly modified by emotion; indeed, to such an extent that it is hard to be recognized as reason. There is very little emotion connected with the elation of arriving at the Q.E.D. of a problem in Euclid, but there is some.

Pure logic doesn't exist. If it does, why do we doubt the sincerity of our fellows? A man comes to us with a statement reading as follows: "The absence of radiographic evidence of infection at the apex of a pulpless tooth never excludes the presence of infection," or, "54 per cent of 490 pulpless teeth with negative radiograph showed one or more colonies." Why do members of the medical and dental professions pass such pulpless teeth with negative radiographs as harmless?

Possibly they have not read or heard the facts, or, having heard, they doubt the man's sincerity, or his ability to make bac-

teriologic studies. These are possible excuses, but the real cause lies in their modified reasoning powers. Age, traditions, environments, selfish emotions, and subconscious desires and wishes have changed their reasons so that the acceptance of new scientific truths is well-nigh impossible.

Failure to accept data such as quoted above is not all. Axiomatic, radiographic evidence often fails to arouse some self-satisfied and opinionated men to act in accordance with the generally accepted dictates of health and hygiene. They rear and paw the air with denunciatory declamations against the medical man whose one thought is to help his patient—to eliminate all possible pathological foci. Here is a statement for such a ranter. No tooth, no matter in what location, nor what the age of the patient, is important enough *per se* to remain in the jaws, if its innocuousness is not established.

The rarefaction so many look for as a guide simply records local liquefaction necrosis about the apex. This is the result of a local reaction or warfare, or, as Price puts it, a local quarantine, as it were. If rarefaction be not present in the apical space about a pulpless tooth, the infection may be there, but not localized, which is far worse for the host than the first condition.

If there is any lament to be made at this time, it does not lie along the line of grief for the decrepit, health-menacing, pulpless tooth. This is misplaced sympathy. It is the "sob stuff" of the daily papers trying to save an arch-criminal. But the lament should be made, and is made in certain quarters, that underground activities are at work in the dental profession to delegate to half-trained persons its most hopeful and serviceable activity, namely *prophylaxis*.

C. F. B. STOWELL, D.D.S.

COLLEGE OF RADIOLOGY

The College of Radiology held its annual meeting at Atlantic City, May 27th, at which a convocation was held for the installation of new members.

Dr. W. H. Stewart presided. Dr. P. M. Hickey was elected president-elect and succeeds Dr. Samuel Beresford Childs, who was installed as president towards the close of the session.

Dr. A. E. Barclay, of Manchester, England, was the guest of honor. The committee for the standardization of hospitals and under-graduate and post-graduate teaching was continued.

AMERICAN MEDICAL ASSOCIATION SESSIONS ON RADIOLOGY

The Sessions on Radiology which heretofore have been held in the Section of Miscellaneous Topics, will hereafter be held in the newly established Section, "Radiology."

This Section was created by the House of Delegates at its last meeting. The present officers are: A. M. Christie, M.D., *chairman*; H. M. Imboden, M.D., *vice-chairman*; M. J. Hubeny, M.D., *secretary*. The Executive Committee is composed of Willis F. Manges, M.D., P. M. Hickey, M.D., and A. C. Christie, M.D.

James T. Case, M.D., was elected delegate and E. C. Ernst, M.D., alternate delegate to the House of Delegates.

The Cleveland Radiological Society is making active preparation for the entertainment of the members and friends who will attend the December meeting of the Radiological Society of North America. Local committees have been appointed, with the approval of Dr. Erskine. (See RADIOLOGY, July, p. 76.)

The officers of the Cleveland Radiological Society are as follows: President, Dr. J. D. Osmond; vice president, Dr. A.

Strauss; secretary and treasurer, Dr. E. P. McNamee. The time and place of meeting is the University Club at six o'clock on the fourth Monday of each month.

The Inter-state Post-graduate Assembly of America will be held at St. Paul, Minnesota, October 12-16, inclusive, 1925. The list of those who have thus far accepted the invitation to appear on the scientific program numbers over fifty names, many of them illustrious in medicine, representing colleges in every section of the United States and Canada. Detailed information may be secured by writing to Edwin Henes, Jr., M.D., 445 Milwaukee St., Milwaukee, Wis., Secretary.

CATHOLIC HOSPITAL ASSOCIATION

COMMITTEE ON RADIOLOGICAL DEPARTMENTS: REPORT OF PROGRESS

Since making our last report we have received 182 replies to the questionnaire. Out of this number, 140 of the hospitals making replies are equipped with radiographic service and dark room; 136 have fluoroscopic equipment; 103 do superficial therapy; 55 deep therapy; 89 have a Sister in charge of the department; 53 have nurses in training; 34 have interne service and 13 have pupil technicians; 52 are equipped with a bedside unit and 113 with the Bucky diaphragm; 126 insist on general examination before the X-ray; 55 use written requisition blanks and 38 use written reports.

In 77 the X-ray department is adjacent to the surgical department; 95 have a physician in charge of the X-ray department; 86 have the interpretation made by the radiologist; in 52 the interpretation is made by the attending physician; in 71, where treatment is given it is directed by a radiologist, and in 57 by the attending physician; in 110 the radiologist is considered as a consultant with the other members of the

staff; in 16 the radiologist is paid a salary; in 8 institutions the radiologist owns the equipment.

Out of 55 having deep X-ray equipment, 50 are supervised by the radiologist; 117 hospitals own their equipment; 110 of them pay the running expenses of the equipment; 120 collect the fees for the department and 111 of them fix the charges; 122 file the X-ray findings with the patient's chart; in 120 emergencies are cared for by the technician, the radiologist reviewing the findings later.

April 24, 1925.

CASE REPORTS

Will all members of the Radiological Society of North America consider themselves hereby invited to send Case Reports to RADIOLOGY, to be published under the heading "Case Reports" or "Case Reports and New Devices," as the case may be? Let these be concise statements of the essential facts concerning the case, illustrated with from one to four roentgenograms (glossy prints, mounted) or India ink drawings. Such a presentation introduces your case into medical literature, and you may later find that other writers quote you; in fact, interesting sequelæ have resulted from some of our published Case Reports.

A NEW SERIES OF TECHNICAL PAPERS

Mr. Ed. C. Jerman, identified with the Victor X-ray Corporation, of Chicago, has prepared a series of technical articles of especial interest not only to technicians, but also to roentgenologists who wish to be progressive. These will appear in RADIOLOGY from month to month, and the following titles, among others upon which Mr. Jerman will write, indicate the scope of the

series: X-ray Technic: From the Old to the New—Co-operation—Protection from an X-ray Standpoint—The Three Important Essentials in the Development of the X-ray Art—The Four Factors which Contribute Most to the End-result: The Film—Calibration of Equipment.

BOOK REVIEWS

DISLOCATIONS AND JOINT-FRACTURES. By FREDERIC J. COTTON, A.M., M.D., F.A.C.S., Visiting Surgeon to the Boston City Hospital; Consulting Surgeon to the N. E. Hospital for Women and Children and to the Beth Israel Hospital and to the Peterborough Hospital; Consultant in Surgery to the Veterans' Bureau; Associate in Surgery, Harvard Medical School. Second ed., one vol., 745 pp., illustrated, with many drawings by the author. W. B. Saunders Company, Philadelphia, 1924.

This is the second edition of this excellent work, revised and in part rewritten, containing a greater number of illustrations than the first edition. However, notwithstanding the large scope of this volume, it still maintains and represents first-hand observations and descriptions of the author.

The volume is a veritable fountainhead of information, the entire work being practically devoted to indications, technic, and the armamentarium necessary to operative or corrective procedures. The text is comprehensive, though briefly written, and in many instances outlined; in short, containing little of a superfluous nature.

The illustrations are many and consist of roentgenograms, sketches, and photographs, all chosen for their actual value, giving one at a glance the impression of a comprehensively illustrated work.

Besides the actual reductions of fractures, dislocations and open operations, all of which the author minutely describes, as well as the aftercare, in many instances special operations are described to illustrate a point.

While the greater part of the work is not original, it is noteworthy in the thoroughness of its compilation, its accessibility, intelligent divisions and indexing, demonstrating the versatility of the author with his subject. All these features combine to make this volume especially valuable as a reference work both for the surgeon and the general practitioner.

JOHN SIEBEL, M.D.

AN X-RAY ATLAS OF THE NORMAL AND ABNORMAL STRUCTURES OF THE BODY. By ARCHIBALD MCKENDRICK, F.R.C.S. (Edin.), D.P.H., F.R.S.E., Surgeon-in-charge of the Surgical X-ray Department, Royal Infirmary, Edinburgh; Examiner, Royal College of Surgeons, Edinburgh, and CHARLES R. WHITTAKER, F.R.C.S. (Edin.), F.R.S.E., Assistant Lecturer on Anatomy, Surgeon's Hall, Edinburgh; Examiner, Royal College of Surgeons, Edinburgh. First edition, cloth, 222 pp. Price \$10.00. William Wood & Co., New York, 1925.

As the title will suggest, the authors have undertaken a work which might easily fill several volumes. As a result of endeavoring to include such a comprehensive subject in one book, many structures receive incomplete attention and some are passed over almost without mention.

The section devoted to the normal and abnormal structures of bone is well arranged and presented. Much can be learned from a study of the plates showing joints radiographed with various positions of the tube; and the desirability of adapting the position of the tube to the structure to be visualized is well illustrated.

It is to be regretted that the respiratory and gastro-intestinal tracts are dismissed with such little consideration, and the space afforded them is quite out of proportion to their roentgenologic significance.

The illustrations are particularly well reproduced on a fine quality of paper, and the text is noticeably free from typographical errors. Notwithstanding its limitations, this work represents one of the best of its kind and the student,

as well as the more experienced, will find it a worthwhile book for reference.

J. D. CAMP, M.D.

INTERNATIONAL CLINICS. Vol. 1, 35th Series, March, 1925. J. B. Lippincott Company, Philadelphia.

This volume of the "International Clinics" contains its usual generous quota of plates and figures, a fact which adds interest and finish to any volume. Reviewing it and reviewing the dictionary have some analogy—variety of subjects and, frequently, new ideas.

The chapter on "Group Medicine," by Dr. Charles D. Lockwood, appears *apropos*, since so many groups are being formed throughout the country.

The chapters are grouped under six general heads: Medical Clinics; Diagnosis and Treatment; Mental Disturbances; Surgery; Toxicology, and Progress of Medicine for 1924. The last-named group contains abstracts of most of the outstanding articles of the past year. It points out the need of a digest of the abundant available material, so that it may be a ready reference in the form of an outline for the student, as well as a permanent, accurate record for the future.

The various articles on general medical and surgical subjects are well worth reading and are valuable for reference.

The only criticism offered is a general one. Some statements are rather thoughtlessly disparaging to the general practitioner, who has trials enough, surely, and needs help and encouragement from his fellows.

B. C. CUSHWAY, M.D.

ABSTRACTS OF CURRENT LITERATURE

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Editorial on gold treatment.—In the April 4, 1925, issue of the *British Medical Journal*, Professor Moellgaard, of Copenhagen, has published an account of the theory and principles underlying his treatment of tuberculosis with gold salt. He claims curative results in animals mostly in cases of exudative pneumococic type of tuberculosis of the lungs. Other experimenters have demonstrated that it is pos-

sible to cause typical "productive" tuberculosis to heal in its earliest stages, with sclerosis and calcification, and clinical experience has shown that cases of acute extensive miliary tuberculosis of the lungs can be brought into a condition favorable for healing. The term "productive tuberculosis" puzzled the Editor of the *Journal*. The explanation offered by Moellgaard is that the distinction between the exudative and productive forms of tuberculosis of the lungs has reference to Aschoff's views of the pathological anatomy of pulmonary tuberculosis. These terms have generally been adopted in Scandinavia, because the distinction is confirmed by X-ray examination. Aschoff applies the term "exudative tuberculosis" to caseous pneumonia in all its stages, not only as a large lobular infection, but as a pneumonic process around other tuberculous foci. The principal features of this type are exudation of fibrin and white blood corpuscles, accompanied by desquamation of the alveolar epithelium, as in the case of other forms of pneumonia. In the roentgenogram they appear as soft, formless, wool-like infiltrations, and there is no pleurisy. By "productive tuberculosis" is understood a process, the principal feature of which is the building up of new fibrous tissue and the production of real tubercles. The roentgenogram shows a spotted and striped infiltration with sharper outlines than in the exudative type. Moellgaard regards the distinction between these two forms as very important in treatment with the gold salt, because the results of the treatment as shown by the roentgen ray are different. In the exudative cases the infiltrations in the picture disappear almost completely, but in the productive cases the infiltrations grow sharper under the gold treatment, because of the fibrous tissue that is formed.

A report by the Medical Research Council on the therapeutic results with the gold salt will be published before long.

SOLOMON FINEMAN, M.D.

The Gold Treatment of Tuberculosis. Editorial, Brit. Med. Jour., April 4, 1925, p. 668.

Gold treatment in tuberculosis.—This is a preliminary report issued by the British Medical Research Council upon the effects of the injection of "Sanocrysin" in the treatment of tuberculosis.

"Sanocrysin" is the trade name of a soluble complex salt of gold and sodium introduced recently by Professor Moellgaard, of Copenhagen, for the therapy of selected cases of tuberculosis. The report was made when work in England had been in progress for less than three months and about thirty cases were studied.

Twenty-two of these definitely had tuberculous infection of the lungs.

The clinical experience in Britain confirms the observations of the Danish workers. The drug does appear clinically to have a specific action on tissues infected by tubercle bacilli, and the severity of the constitutional reactions does appear to be directly related to the intensity of the tuberculous infection. Further, the drug seems to have but slight toxicity for human patients who are not infected with tuberculosis, though in this respect very few control observations have been made.

Two of the pulmonary cases died, death in one hopeless case being perhaps accelerated by the treatment, and occurring in the other unexpectedly as the result of toxic jaundice. The remaining twenty do not lend themselves to any numerical analysis. The opinion of those observers who have had most experience in dealing with tuberculosis is that the early cases of open tuberculous infection of the lungs did show some evident improvement, though there was no dramatic benefit, such as that seen with insulin or salvarsan in their corresponding diseases. On the other hand, cases with more advanced disease did not stand the treatment well, and the condition of some of these had been made worse. This also is in accord with the findings of Dr. Secker, of Copenhagen, the chief clinical colleague of Professor Moellgaard.

The evidence on the whole is considered by the British Medical Research Council to be sufficiently encouraging to demand further clinical study. This is particularly so in view of the one experience common to all observers—namely, that the drug seems to exert a specific action on tuberculous tissues.

SOLOMON FINEMAN, M.D.

The Gold Treatment of Tuberculosis. Preliminary Report by the Medical Research Council. Brit. Med. Jour., April 18, 1925, p. 735.

Vomiting in infancy.—Persistent vomiting in infants may be due to dyspeptic states of all sorts, pyrexial infective disorders, purely functional disturbances of the gastric movements, inco-ordination of the intestinal musculature, and to developmental defects in the upper alimentary tract resulting in obstruction.

Duodenal obstruction may be of intrinsic or extrinsic origin; the former due to duodenal atresia and stenosis, and the latter to abnormalities of intestinal rotation.

The early recognition of duodenal obstruction is of great practical importance because the condition occurs frequently and because the infant's life can at times be saved by early operative procedures. Intrinsic duodenal obstruction may

be caused (1) by a diaphragm or membrane, perforate or imperforate; (2) by the interposition in the length of the bowel of a fibrous cord-like structure which may or may not contain a narrow lumen; (3) by complete separation of the gut, which terminates blindly and begins again after a gap which is completely unbridged.

Extrinsic duodenal obstruction is thought to result chiefly from derangements in intestinal rotation during embryonic life, such as non-rotation with a left-sided cecum and appendix, reversed rotation with the duodenal loop crossing in front of the superior mesenteric artery and with the colon most posterior of all, mal-rotation with reversed rotation of the pre-arterial segment, and arrested rotation of the post-arterial segment. The abnormal disposition of the intestine implies abnormal attachments and fixation of the peritoneal folds. Undue fixation may cause kinking of the bowel, especially at the duodeno-jejunal flexure, or there may be direct pressure upon the duodenum by the superior mesenteric artery or by abnormal peritoneal folds. On the other hand, undue want of fixation predisposes to volvulus.

In cases of intrinsic duodenal obstruction the roentgen examination after an opaque meal can hardly fail to make the diagnosis clear. The duodenum is seen as a widely distended pouch, ending abruptly at the site of the obstruction. Postmortem records show a large number of cases which almost certainly might have been saved had the diagnosis been established in the first days of life by means of the characteristic roentgen-ray picture. In the literature, however, only one other case in addition to the author's own case has been reported as having been saved by timely operation.

In cases of extrinsic duodenal obstruction, the diagnosis again is only likely to be made with certainty by means of the roentgen ray. The examination must be directed to the elucidation of two points: first, a delay in the emptying of the duodenum with dilatation and occasional reversed duodenal peristalsis, and secondly, the demonstration of abnormalities in the position of the cecum and ascending colon. In such cases the probability that one is dealing with duodenal obstruction resulting from abnormalities in peritoneal fixation is greatly strengthened.

True organic pyloric stenosis is very rare. On the other hand, hypertrophic pyloric stenosis is very common, and the great frequency of this condition is now fully appreciated.

Esophageal obstruction due to stenosis or atresia occurs infrequently. Atresia results from an abnormal development of the tracheoesophageal septum. By far the most common

form is that in which atresia of the esophagus is combined with an opening between the lower esophagus below the atresia and the trachea. In these cases death almost invariably follows within a few days after birth from a bronchopneumonia resulting from attempts at food ingestion. In these cases the shadow of an opaque meal clearly shows the site of obstruction.

In esophageal stenosis, as distinct from atresia, symptoms are seldom prominent during infancy while the diet remains fluid. These cases present themselves for examination later in childhood.

SOLOMON FINEMAN, M.D.

1. *Some Forms of Vomiting in Infancy.* H. C. Cameron. *Brit. Med. Jour.*, April 25, 1925, p. 765.

Vomiting in infancy.—The first large group of cases discussed by the author (p. 175) was that due to developmental defects in the upper alimentary canal. A second form of obstruction is that due to neuromuscular inco-ordination. Bayliss and Starling have shown clearly that a bolus of food produces a twofold reaction in the muscular tube—a contraction in the segment above accompanied by relaxation in the segment below. These peristaltic movements persist in an isolated loop of gut separated from its central nervous connections. Nevertheless, the intestine is possessed of a double nervous supply, which has the power of augmenting or inhibiting intestinal tonus and movement.

In considering the etiology of this group of disorders in infancy, characterized by a temporary failure of the inhibitory apparatus of the bowel, the writer puts forward the hypothesis that in development the inhibitory apparatus is apt to lag behind the motor apparatus. In the case of the skeletal musculature a similar functional retardation of inhibition is the rule. In cases of infantile "achalasia" at the cardia and pylorus it may be said that the time limits of the obstruction appear definite. In the case of the pylorus, certainly, if the infant does not succumb to intercurrent infection, recovery may be confidently predicted in the fourth or, at latest, the fifth month. Once the functional weakness at the pylorus has been overcome relapse never occurs. This certainty and this permanency of recovery are in keeping with the view that the symptoms are due to a retardation of functional development.

Recent radiographic studies of Hurst have afforded proof of the correctness of the supposition that, in the case of the cardia, in failure of relaxation of the ring muscle of the sphincter lies the primary cause of the obstruction. He has coined the word "achalasia" to describe the condition. Fluoroscopically, the failure of the

cardia to relax is clearly evident, while post-mortem examination in these cases shows that, although there is hypertrophy of the walls of the dilated esophagus above the obstruction, the ring muscle itself shows no trace of hypertrophy.

The explanation of the remarkable condition found in hypertrophic pyloric stenosis has been the subject of endless controversy. The view that the obstruction at the pylorus is due to pressure from the bulk of muscle, the subject of a congenital hypertrophy, seems to the writer to be illogical. No true stenosis of the pyloric canal is present. Within the grip of the rigid musculature of the pyloric cylinder there lies a normal pyloric canal, its lumen in no way narrowed, but, as it presents itself at autopsy, so folded up that its outline is rosette-shaped upon transverse section. During life the obstruction is not constant, but intermittent. Thomson was the first to enunciate the more reasonable hypothesis of a neuromuscular inco-ordination. In the light of the present knowledge of a corresponding neuromuscular obstruction at the cardia, which we owe chiefly to Hurst, the writer offers the theory that here, too, there is a primary failure of the pyloric sphincter to relax, or, to use Hurst's expression, an achalasia of the sphincter.

The term "congenital hypertrophic stenosis" is misleading for three reasons. In the first place, there is no true stenosis present. In the second place, histologic evidence shows that the ring muscle itself takes no part in the hypertrophy. (Sections through the pyloric region in a normal infant and in an infant with "hypertrophic pyloric stenosis" are reproduced in this paper.) The hypertrophy involves not the sphincter, but the contractile pyloric portion of the stomach. In other words, there is no hypertrophy of the retaining, but of the expelling, apparatus of the stomach. The third error lies in the use of the word "congenital." Only one observer, Dent, has reported this condition in a fetus. It is possible that he may have mistaken the very rigid and tightly contracted pyloric cylinder normal in the fetus for the pathological condition with which he was familiar. If the disorder be truly congenital, its frequency is so considerable that it is inconceivable that examples should not be forthcoming from among infants submitted to autopsy within the first weeks of life.

The so-called cases of pyloric spasm without pyloric hypertrophy are probably likewise due to achalasia of the pyloric sphincter. It may be that the reason for the absence of hypertrophy in these cases is due to the ease with which the food escapes through the cardiac orifice. It is possible that hypertrophy is produced only

when escape by the cardia is achieved with difficulty, and when phases of violent and exaggerated peristaltic activity are prolonged.

SOLOMON FINEMAN, M.D.

II. Some Forms of Vomiting in Infancy. H. C. Cameron. *Brit. Med. Jour.*, May 2, 1925, p. 815.

Stomach diverticula.—Diverticula of the stomach are invariably situated in the immediate neighborhood of the cardia. Such diverticula are comparable to the more common diverticula which occur where a weak spot is present at the junction between the pharynx and esophagus. True diverticula of the stomach are generally about the size of a cherry, their walls formed of mucous membrane, which is generally atrophic, with a very thin and often incomplete layer of muscular tissue.

The authors report four cases, briefly review the literature, and call attention to the rarity of this condition. The American literature on the subject has apparently been overlooked.

J. D. CAMP, M.D.

Diverticula of the Stomach: A Possible Source of Error in the Radiological Diagnosis of Gastric Ulcer. A. F. Hurst and P. J. Briggs. *Brit. Jour. Radiol.*, Jan., 1925, p. 1.

Tonsils treated by radium.—In the experience of the author all the tonsils treated by roentgen rays alone show, on examination, definite masses of lymphatic tissue in the tonsillar fossa. These results do not compare favorably with the results following the application of radium directly on or into the tonsil.

The tonsil is swabbed with a 2 per cent solution of cocaine and the unfiltered window of the radium plaque is held directly against the surface of the tonsil by a compass-shaped tonsil hemostat for thirty minutes. The oval shape of the plaque allows it to fit snugly between the pillars. A slight blanching of the surface appears in one week, some local soreness follows, seldom lasting over three days, and at least 30 per cent of the patients fail to notice any local tenderness or pain. This treatment can be used only in the case of older children. One treatment will reduce the tonsil as much as four or five applications of roentgen radiation. The largest tonsils have never required over four treatments at three-week intervals. The average case required three treatments.

In adult patients with sensitive throats, in children, and in cases where quick results are desired, glass emanation seeds of varying strengths are used. The reaction and pain accompanying the use of one-half and one millicurie seeds make their use impractical. The

author now employs seeds of not over one-fourth millicurie. The number implanted depends on the surface extent and size of the tonsil. The tonsil of average size can easily hold two seeds. Extreme care should be exercised to have no seed nearer a pillar than 0.5 cm. and the same distance should separate each of the two to four seeds. At the end of three to five days the tonsil swells, becomes red and tender and shows two or three small white blanched areas, the size of a wheat seed. The patients may complain of earache and sore throat for three or four days. At the end of eight or ten days the tonsil becomes pale and a decrease in size is noted. This shrinkage progresses during the following two weeks, at the end of which time not a vestige of a previously protruding tonsil may be seen. In many cases one treatment causes the tonsil to vanish.

Radium atrophy of tonsils constitutes a real advance in medicine, and is indicated in a class of patients who, because of constitutional defects and lesions, should not be subjected to the risks, pain and prostration of operation.

J. D. CAMP, M.D.

Radium Treatment of Tonsils. C. A. Simpson. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 527.

Technic for breast carcinoma.—These are observations based on 281 cases of microscopically diagnosed carcinomata of the mammary gland treated with surgery, radium, and roentgen rays. One hundred and twenty-four were primary and 157 had recurred either after a radical amputation or a simple mastectomy or excision of the tumor. Almost two-thirds of the cases occurred between the forty-first and sixtieth years of life.

The chest was radiated through four areas, three anterior and one posterior. The roentgen rays for the anterior areas were produced with 140 KV., a focus skin distance of 50 cm. and a filter of 0.1 mm. Cu. plus 1.0 mm. Al. When the breast was very large and thick 0.2 mm. Cu. plus 1.0 mm. Al. filter was used. The duration was 200 ma.-min., using the 0.1 mm. Cu. filter and 350 ma.-min., using the 0.2 mm. Cu. filter. The factors for the posterior fields were 200 KV., 50 cm. focus skin distance, 1.0 mm. Cu. plus 1.0 mm. Al. filter and 600 ma.-min. The skin reactions obtained by these rays were characterized by an intense erythema and peeling of the superficial layers of epidermis. A deep tanning appeared in six weeks.

The roentgen radiation absorbed by the tissues does not suffice to degenerate or destroy the tumor cells permanently, therefore radium rays are added. These are administered either by

pack or needles. The pack is 6 x 10 cm. in size and 3 cm. in thickness, and 200 or 400 mg. of radium element is filtered through 1.5 mm. brass. The duration of application is 14 hours with the 200 mg. pack and 7 hours with the 400 mg. pack. In a large breast and heavy chest walls needling is preferred, using a 10 mg. element needle for from 8 to 10 hours to each square centimeter of surface. The needling is begun at the periphery, encircling the growth in the healthy tissue. The next circle is placed 1 cm. inside the first, and so on. Finally this is carried along the pectoralis major muscle, placing needles between it and the chest wall. In operable cases surgery is performed the day following the completion of the treatment. The radium pack is applied to the supraclavicular axillary regions and chest when convalescence from the operation is complete.

Up to and including 1918 there were 91 primary and recurrent cases with a five-year cure of 20 (22 per cent). Up to and including 1920 there were 129 cases with 27 three-year cures (20 per cent). The author observed that patients treated according to this method, in whom the cancer recurred, would have the recurrence and die from cancer before the end of three years.

J. D. CAMP, M.D.

The End-results of the Treatment of Carcinoma of the Breast with Surgery, Radium and Roentgen Rays. Henry Schmitz. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 531.

Sacro-iliac joint conditions.—In regard to the interpretation of roentgenograms of sacro-iliac joint conditions these are best considered under the following headings: (1) Sacro-iliac strain or relaxation; (2) Inflammatory conditions. In the majority of acute cases (strain or relaxation) the roentgenograms are negative. They may show disalignment, which is best demonstrated at the pubis. In chronic cases proliferative changes are frequently seen along the inferior joint line at the pubis, and at the attachment of the iliolumbar ligaments. Proliferative changes in the last-named region are also present in cases of lumbro-sacral strain. In chronic cases there may be increased density along the joint line, but this is not so common a finding as the proliferative changes. Disalignment also may be present, the same as in acute cases.

In the early stages of tuberculosis there is increased density along the joint line and in the soft tissues at the inferior margin of the joint. In the later stages there is, in addition, erosion of the joint line and bone atrophy in the ilium and in the sacrum.

Gonorrheal arthritis is more apt to involve the entire joint than is tuberculosis; it is frequently bilateral. In the early stages there is markedly increased density along the entire joint line and this increased density is more intense than in tuberculosis. In the later stages there is, in addition, erosion of the joint line and areas of bone fusion.

In the early stages of infectious arthritis the appearance is very similar to early tuberculosis and it is impossible to differentiate between the two. In chronic infectious arthritis, however, the bone atrophy is very much less marked than in tuberculosis.

J. D. CAMP, M.D.

Clinical Diagnosis of Common Sacro-iliac Conditions. M. N. Smith-Petersen. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 546.

Multiple myelomata.—A very brief review of the literature concerning multiple myeloma, with a report on one case proved by necropsy. The roentgenograms showed an advanced destructive process involving the entire spine, pelvis, trochanteric region of both femurs, clavicles, ribs and skull.

J. D. CAMP, M.D.

Multiple Myelomata. W. J. Stone. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 543.

"Dilated diploic veins." — With improved technic and particularly with the aid of the Potter-Bucky diaphragm so-called "dilated diploic veins" can be demonstrated in many apparently healthy individuals. Therefore great care must be exercised in estimating the value of this roentgen finding in any given case, and unless roentgenograms after an interval distinctly show an increase of the diploic channels, no importance should be attached to the presence of either unilateral or bilateral dilatation of the diploic channels. These veins may be observed in only one portion of the skull, or on one side, or on both sides. The pattern varies with the individual and may vary on the two sides of the same individual. Prominent convolutional markings on the skull may be present in apparently healthy individuals. Apparently healthy individuals may show: marked irregularities in the inner table of the skull; extensive depressions for the Pacchionian bodies; prominent suture lines and deep grooves for the meningeal vessels. Calcium deposits in the pineal gland can be demonstrated in healthy individuals in early adult life.

J. D. CAMP, M.D.

Dilatation of Diploic Veins and Other Anatomical Variations in the Skull. L. T. LeWald. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 536.

Impaired hearing.—The author is of the opinion that in a case of impaired hearing with absence of lymphoid nodules on the posterior pharyngeal wall and open Eustachian tubes, no improvement seems to result from roentgen-ray therapy. In cases with lymphoid nodules on the posterior pharyngeal wall and prominent bands of lymphoid tissue running up on either side of the pharynx, just posteriorly to the posterior tonsillar pillar, an improvement in hearing results in proportion as the throat condition is influenced.

The favorable effects are due, in the author's opinion, to a diminution in the blood supply of that part of the upper respiratory tract treated with small doses of roentgen rays. This results in a destruction of existing micro-organisms and a diminution in the size of lymphoid tissue. The improvement of the aural condition seems to be proportionate to the improvement of the throat condition.

SOLOMON FINEMAN, M.D.

A Study of the Effect of Roentgen-ray Therapy upon Impaired Hearing. D. C. Jarvis. *Annals of Otol., Rhinol. and Laryngol.*, Dec., 1924, XXXIII, 1307.

Stenosis of esophagus.—In cases of cicatricial stenosis coming to the Bronchoscopic Clinic of Chevalier Jackson, lye burns have been by far the most common cause of stricture. These strictures were found most often at the level of the anatomic or physiologic narrowings of the esophagus. According to Chevalier Jackson, they occur, first, in point of frequency, at the level of the crossing of the left bronchus; next, in the region of the cricopharynx; next, at the hiatal level. Stricture at the cardia is rare.

In the diagnosis of this condition the employment of a bougie blindly is not justifiable at the present day. It is dangerous, inefficacious, and unnecessary since the development of esophagoscopy. But even esophagoscopy should be preceded by roentgen-ray examination. Fluoroscopic and roentgenographic studies by swallowing of an opaque mixture will often make the differential diagnosis as to other lesions. In cases of children who refuse to swallow the mixture, the method used by H. K. Pancoast may be used. It consists of injecting a bismuth mixture into the esophagus through a catheter put through the nasopharynx. In this manner a stricture may be demonstrated, which cannot be shown otherwise.

SOLOMON FINEMAN, M.D.

Cicatricial Stenosis of the Esophagus, with Particular Reference to Treatment by Continuous String, Retrograde Bouginage with the Author's Bougie. Gabriel Tucker. *Annals of Otol., Rhinol. and Laryngol.*, Dec., 1924, XXXIII, 1180.

Erythema dose.—From observations made on a large group of patients, the authors find that there is a maximum variation of at least 50 per cent in the time in which a reaction of normal skin definable as an erythema can be produced with roentgen rays, with the factors given. Regardless of the technic, provided it is kept constant, very little uniformity of reactivity of patients is observed.

The authors conclude that the erythema (skin unit) dose is a flexible, arbitrary, and inaccurate standard. Dosimetry based on it has a relative value individual to the judgment of the radiologist. If used as a basis of comparison of technic its threshold value is more practical than its intensity. In reporting technic in therapy full data should be given until a definite standard is established.

J. D. CAMP, M.D.

Erythema as a Unit in Deep Roentgen Therapy Dosimetry. E. T. Leddy and J. L. Weatherwax. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 514.

Roentgen therapy machines.—Tables and graphs are presented showing the contrast between a kenotron-rectified machine on autotransformer control and a disk-rectified machine on resistance control. The curves show the roentgen rays delivered through three different filters, 1 mm. Al., 0.25 mm. Cu. plus 1 mm. Al., and 0.5 mm. Cu. plus 1 mm. Al. The disk-rectified machine was found to give 98.5 per cent of its roentgen rays in the middle half of the wave compared to only 88 per cent from the kenotron-rectified machine in the same portion of the cycle. The figures for the central one-thirds of the cycle are 84 per cent for the disk and 70 per cent for the kenotron.

The authors conclude that high voltage roentgen therapy machines differ by as much as two times in their roentgen-ray output per milliampere-minute, even when crest kilovolts, filter, distance, and area and mass irradiated are the same.

J. D. CAMP, M.D.

Wave Form and Efficiency: An Analysis of Roentgen Therapy Machines. W. E. Chamberlain and R. R. Newell. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 509.

Capillary tubes versus metal alloy needles.—From their experience with capillary tubes containing from 0.5 to 1.0 mc. the authors object to the use of emanation in this manner for the following reasons:

1. As one of the causes of cancer is prolonged irritation, it seems irrational to scatter in the tissues ten, twenty or more minute hard,

foreign bodies; particularly so, in the tissues where considerable movement occurs, such as those of the tongue, muscles of the neck, etc.

2. Theoretically these tubes should be planted at equal distances in the tumor to produce even radiation, but, practically, this is almost impossible. Several tubes will be planted too close together, resulting in an overdose, while other parts will receive, conversely, insufficient treatment.

3. The glass walls of the tubes are not thick enough to filter out sufficient of the beta rays, hence there is frequently produced an intense local reaction, followed by sloughing, pain, and heavy fibrosis, which so cuts off all circulation to the part as often to result in further necrosis.

4. When once the tubes are planted, control over them is lost.

5. The prolonged action of the emanation in buried tubes appears to have a particularly devitalizing effect on bone.

6. Pain is almost always a severe and persistent symptom.

On the other hand, the advantages of using radium or emanation in metal alloy needles are: (1) The needles being in the tissues for a regulated time only and then withdrawn, no irritating foreign body remains. (2) With needles of different sizes and lengths it is not impossible nor a very difficult matter to embed the emanation or element at comparatively equal distances throughout the tissues. (3) The hyperirritating beta radiations are filtered out and their undesirable effects therefore avoided. (4) The time is under perfect control. (5) Bone necrosis has been observed to be less frequent with the needles. (6) Pain is certainly much less than with buried glass tubes.

J. D. CAMP, M.D.

Objections to the Use of Radium Emanation in Bare Tubes, with Clinical and Histological Observations. W. L. Clark, J. D. Morgan, and E. J. Asnis. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 519.

Radiotherapy survey.—S. Gilbert Scott, of the London Hospital, is of the opinion that the present tendency to substitute physics for biology and medicine can only hinder sound progress in radiotherapy. The reports from various countries make one realize that even under the best conditions the results of homogeneous high voltage radiation are, on the whole, disappointing.

Radiation does not destroy or remove unwanted cells as does the cautery or the knife. Profound changes are set up which allow them to be absorbed and replaced by healthy cells. This is important to remember, for it means that

malignant cells can be made to undergo a change, resulting in their replacement by normal tissues, without necrosis taking place—in short, a metamorphosis without cellular death.

Tissue reaction plays an important part. If, for some unknown reason, this reaction fails, no amount of radiation will succeed in destroying the pathological cells.

Uniform dosage for all the various forms of carcinoma or all varieties of sarcoma can not be entertained. The human body can not be treated as if it were merely just so many cubic centimeters of material.

At the London Hospital over two thousand cases of breast cancer have been treated in the last fourteen years. From a study of the results in these cases, Scott concludes that heterogeneous (low voltage) radiation is of greater therapeutic value than homogeneous in the prophylactic treatment of breast cancer. It gives radiation absorption at various depths; a large radiation field can be utilized with minimum general disturbance. The objections to the high voltage method in breast cancer are:

1. The radiation field is necessarily much limited.
2. There is no indication as to the depth at which the dose should be delivered.
3. Damage to the lung tissue is comparatively frequent.
4. General disturbances, such as sickness and blood changes, place too great a strain on the patient.

Whatever form of radiation is used in cases of breast carcinoma, it is useless and against common sense to limit it to local areas. Radiation should, if possible, include the whole trunk. At the London Hospital for the past three years, Scott has treated these cases by the "dual method." This consists of placing the patient between two tubes, both running at the same time. The radiation field includes practically the whole trunk. The results so far have shown, without doubt, a very material improvement.

SOLOMON FINEMAN, M.D.

A General Survey of Radiotherapy in Malignant Disease. S. Gilbert Scott. *Brit. Med. Jour.*, March 28, 1925, p. 596.

Difference in length of corresponding bones.—A male child of seven years whose only complaint was limping was found to have a difference in length of tibia and fibula on the two sides, no constitutional condition being found present, and no history of injury or familial deformity. The condition had been present three years. The muscular movements were normal. X-ray showed no bony changes, but cor-

robored the difference in length and size of the bones. A large vascular nevus covered the entire knee joint, and the author believes that this in some way influenced the vascularity of the knee joint and the growing ends of the long bones.

B. C. CUSHWAY, M.D.

Hypertrophy of the Bones of a Limb Due to a Nevus. Donald Paterson and W. G. Wyllie. *Brit. Jour. Child. Dis.*, March, 1925, p. 36.

Applications of roentgen rays.—In all the history of science there is no more brilliant page covering a period of less than thirty years than that which is concerned with roentgen rays. From the status of a misunderstood and somewhat dangerous plaything, they are only now becoming a useful tool of astonishing versatility and of untold possibilities in the fields of biology, pathology, medical diagnosis, physics, chemistry, and numerous phases of business and industry.

The applications of roentgen rays may be roughly divided into, first, those depending upon direct utilization of the radiation; second, the determination of crystal structures, and, third, the founding or testing of theories of the structure of the atom.

Only within the past four or five years has it come to be realized that industrial products may be examined for internal defects by means of roentgen rays just as successfully as the human body. By means of roentgen rays not only may faulty castings and material be rejected, but an entirely new technic of controlled casting and successful substitution of castings for forgings gained. There has recently been perfected a small portable roentgen-ray apparatus with which plumbers may locate pipes hidden in walls or under floors, electricians may find wires exactly and almost instantaneously, and carpenters may know just where beams and nails are before proceeding to new constructional work. We are not surprised, then, that the roentgen rays are becoming a valuable ally of the detective and customs official in discovering concealed articles of value.

We are coming to know more about the solid state of matter than any other; we have more information bearing upon the actual existence of atoms and of the forces between them than was ever vouchsafed through the intermediation of any other experimental tool. It is now possible to properly correlate these fundamental building blocks of matter from a knowledge of atomic arrangement and dimensions. Since even minute quantities of crystalline substances may be detected by roentgen-ray diffraction patterns characteristic for each, it is obvious that un-

known pure substances or mixtures may be chemically analyzed, particularly if standards for the pure materials are available. The simplicity of roentgen-ray spectra and of the relationship between frequencies and atomic numbers has predicted and triumphantly identified hafnium, element number 72. The minutest traces of the still unknown 43, 61, 75, 85, and 87 in minerals should disclose themselves as characteristic emission lines or absorption discontinuities. All have been sought, but so far without success. It may be confidently predicted that if these elements do exist in matter to which man has access, they will be discovered by the roentgen-ray method.

"Thus we have reviewed thirty-seven, by no means all, of the achievements of the peculiar radiation discovered one day in the Autumn of 1895 by Röntgen. . . . We have seen much of this mystery become clear fact under the hands of Barkla, Laue, the Braggs, Moseley, . . . Siegbahn and all the other experimenters, who, bit by bit, have built up our present knowledge. Who would have dreamed in 1895 that in 1924 great hospitals, dental laboratories, government arsenals, university departments of physics, chemistry, engineering, metallurgy, biology, and medicine, factories producing sulfuric acid, or sheet metal, or paper, or bridges, or automobile tires, or chemicals, custom houses, detective agencies—all would have roentgen-ray laboratories working at top speed? Whither shall the science of roentgen rays have led us in another thirty years?"

J. D. CAMP, M.D.

The Versatility of X-rays. G. L. Clark. *Am. Jour. Roentgenol. and Rad. Ther.*, Dec., 1924, p. 556.

NOTE—This excellent and unique article does not lend itself well to abstracting and for those interested it is recommended that the original be consulted.

Fallopian tube patency: new method.—

The writers feel that the present method of testing tubal patency is unsatisfactory, because of the production of an increased intra-uterine and intra-tubal pressure, in cases in which, from their very nature, it is anticipated that organisms may be lurking in the uterus or the tubes. The authors consider their method a much safer one to employ because it does not depend upon creating a positive intra-uterine or intra-tubal pressure.

On the basis of Bond's experiments, in which he was able to recover colored particles from the peritoneal cavity of rabbits after their previous introduction into the vagina, the authors substituted an emulsion of barium sulphate introduced directly into the uterine cavity with a syringe and cannula. The emulsion is merely

dropped into the uterine cavity and is not forced in under pressure.

Experimentally, Williams and Reynolds showed that the barium particles do not find their way up the Fallopian tubes unless there is a free communication between the tube and the peritoneal cavity. This, to them, suggests that a purely mechanical factor, such as aspiration, is, more likely, responsible than anything in the nature of ciliary activity. If the tubal ostia are patent, the emulsion travels from the uterus to the tube, and, therefore, if the shadow is seen in the tube at all, it indicates patency

of that tube. In the course of seventy-two hours the whole of the bismuth or barium disappears. In no instance have any after-effects been complained of by the patients.

This method is of additional value in demonstrating the size and variations in contour of the uterine cavity.

SOLOMON FINEMAN, M.D.

A Method of Determining the Patency of the Fallopian Tubes by X-rays. Everard Williams and Russell Reynolds. Brit. Med. Jour., April 11, 1925, p. 691.

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